BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY

Vol. XLII 1910 No. 5

THE CAVERNS AND PEOPLE OF NORTHERN YUCATAN

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The northern part of the Yucatan Peninsula, instead of having the luxuriant tropical vegetation often found in countries of low latitude, is in reality a great semi-arid plain. The forests, nowhere dense, dwindle away in parts to a stunted "brush" barely supported by the scanty soil which only partially covers the underlying limestone rock. It is, indeed, to the porous character of this rock and the absence of pronounced relief, rather than to a deficiency in the rainfall, that the aridity must be chiefly ascribed. The porous, fissured limestone rock is like a thirsty sponge which soaks in the water with only less avidity than the hot sands of a desert. Under these circumstances, it is of interest to note that, before the Discovery, this region supported probably the highest civilization of the western hemisphere, and that the conditions of human occupancy at the present time are not wholly unfavorable.*

The great plain of northern Yucatan extends southward from the Gulf of Mexico as a gentle, even slope, at an average increase in elevation of about one foot per mile. To the northward it sinks almost as gradually under the surface of the sea, forming the great Yucatan Bank with a width of some 100 miles, beyond which it

* The writer's personal knowledge of the country has been gained from a trip made early in 1904, the principal object being the collection of zoölogical materials and data. The work was in the interests of the Museum of Comparative Zoölogy at Cambridge, and consisted of a stay of several weeks at Progreso, a few days at Merida and Izamal, and nearly two months at Chichen-Itza.

sinks rapidly to the great depths of the Gulf. There are no harbors on the coast and the shoal water of the Bank makes it necessary for large steamers to anchor some miles off shore, whence freight and passengers are carried back and forth by lighters. Steamers must be ever in readiness to seek deeper water upon the approach of one of the dreaded "northers," those fierce storms that sweep from our southern states across the Gulf and down upon the unprotected coast. The coast itself is low, and, for 170 miles, skirted by a narrow sand reef, behind which lies an extensive lagoon of brackish water, which is called "el rio" and "la cienaga," and which opens to the sea at the west. At only two or three places along the entire reef do tidal inlets occur.*

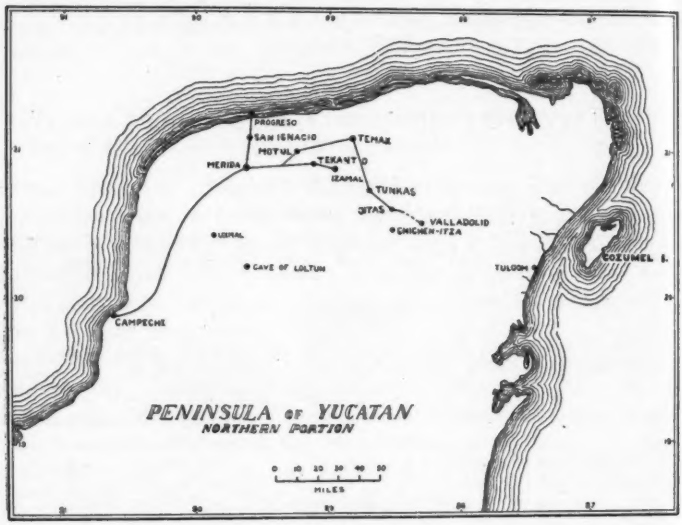

FIG. I.

By the courtesy of the Museum of Comparative Zoölogy, Cambridge.

To the southward of Merida, about 50 miles from the sea, the land rises in the form of a series of low hills, locally known as the "sierra," which have a general trend from northwest to southeast. Their average height is 400 or 500 feet. According to Mr. E. H. Thompson, in the neigrborhood of Xul, they reach a greater elevation of nearly 900 feet (Heilprin, 1892, p. 136). The extent of

* The method of formation of this coastal strip of sand and the consequent lagoon has been ably discussed by Schott (1866).

this range of "mountains" to the southeastward is not accurately known.

At San Ignacio, about half way between Merida and the coast, the general surface appears to be almost as flat and level as a floor; and here one may look for miles, with almost unobstructed view, across the enormous plantations of henequen, the plant which supplies the "sisal" fiber of commerce, and which constitutes one of the greatest sources of wealth in Yucatan. South of Merida, however, the dissection of the plain has progressed further, and the

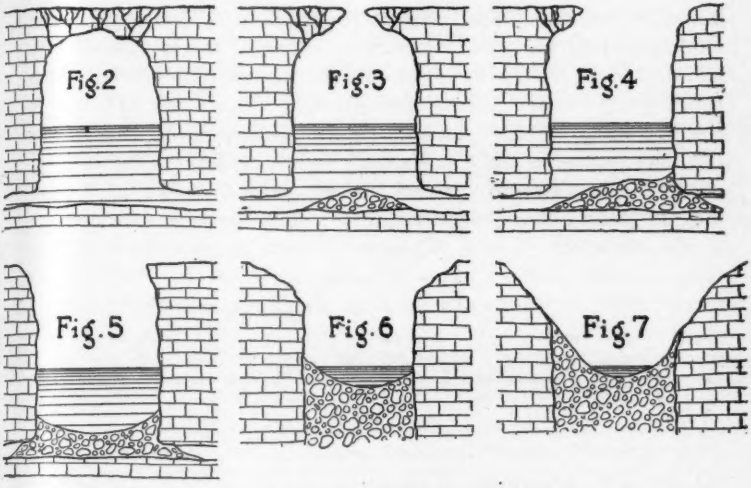

FIG. 2—Dome-shaped cavern, the roof of which has not yet fallen in; 3. A later stage in which the middle of the roof has given way; 4. Most of the roof has given way, but a portion still remains; 5. The typical cenote with vertical walls (see Fig. 7); 6. A later stage in which the walls are being worn back; 7. A topographically old cenote or "aguada" resembling a kettle-hole with a pool at the bottom.

surface topography is much more irregular. On account of the porosity and fissured surface of the limestone that constitutes the country rock, the heavy rains of the wet season cut irregular channels or "arroyas," whose positions are dependent upon the local conditions; but nowhere are these of any great length or permanency. For it should be understood that nowhere in the whole northern half of this great peninsula are there rivers or permanent surface streams, with the exception of a few short ones on the eastern coast; and these, as will be shown later, were probably underground streams whose roofs have fallen in. But in certain parts of the country

there are more or less permanent pools or "aguadas," and water is also to be found in deep caverns and sink holes. Many of the latter are of a peculiar chimney-like structure, and are known as "cenotes." It is with the nature of this underground drainage that the remainder of this paper will be chiefly concerned.

The rainy season in Yucatan is from about July to October. During the rest of the year the rainfall is small, though there may be occasional heavy thunder showers. In all parts of the country, the surface water quickly finds its way underground, and in the hill region it has formed many caverns and subterranean passages, which, if we may judge from the descriptions of those who have explored them, are similar in most respects to the caverns of any elevated limestone region. There is one peculiarity, however, which appears to be rather characteristic of the Yucatan karst, and that is the prevailing vertical character of the underground caverns. In the lower north country horizontal tunnels appear to be entirely absent, or at least very unusual; in the caverns of the hill region they do occur, but are very limited in comparison with such caverns as the Mammoth Cave in Kentucky. In the neighborhood of San Ignacio, between Merida and the coast, are to be found numerous small, round, vertical, shaft-like holes which remind one forcibly of glacial moulins.

The Cenotes

"Cenote" was the name given by the ancient Mayas to the deep waterholes or sinks of Yucatan; and since the character of these peculiar sinks appears to be distinctive, it may be well to retain the name, especially for the deep, circular, vertical-walled holes, without lateral passages, which may be considered as the type of the mature form. Varieties are to be found in the topographically younger dome-shaped caverns, with roofs intact, and the mature "aguadas" with sloping sides.

In presenting what the writer believes to be the most plausible explanation of the somewhat unusual features of Yucatan hydrography, it may be well first to describe what may be taken as the typical cenote, and then by other examples to illustrate their probable cycle of development.

The two well-known cenotes at Chichen-Itza may be taken as examples of what we may consider as typical. But although these have been so long known, and so often described, it is surprising how inaccurate are most of the dimensions that have been given.

The larger of these is known as the Sacred or Sacrificial Cenote because of the fact that, according to legend, and as has recently been confirmed by dredgings, it was a part of the Mayan religious ceremonies to cast into this deep pool human sacrifices who were to intercede with the gods of water for a plentiful supply of that much-needed element. This cenote is nearly circular in outline, with a diameter of 190 feet, while its walls, which are in places vertical, and locally overhanging, are 65 feet high from the level of the water to the general surface of the ground above. It is thus like a great circular shaft or stone quarry with a pool of water at the bottom. This water, which is fresh, is 36 feet deep and occupies the whole diameter of the shaft except at one point where there is a narrow beach. Its dark greenish color is not due, as stated by many, to its depth, nor to the overhanging vegetation, but rather to the microscopic algæ which grow in it. While the side walls have been spoken of as vertical, they are not straight and smooth, but are

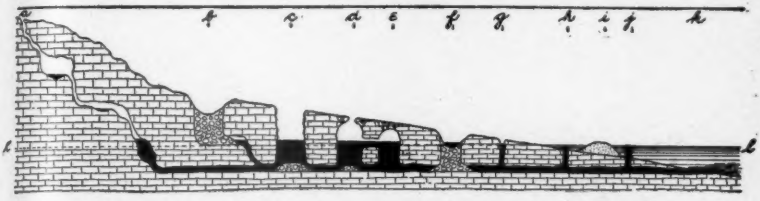

FIG. 8—Schematic North-south section from the "sierra" to the coast illustrating types of cenotes and caverns, relations of water level, subterranean connections, etc. *a*. Hill cavern, with long passages and pools of water held in impervious depressions; *b*. An old age cenote ("holla") holding water only temporary after rains; *c*. Typical cenote (see Figs. 5 and 9); *d* and *e*. Young cenotes or dome-shaped caverns (see Figs. 2 and 3) connected by a passage at water level; *f*. Old age cenote with permanent pool of water ("aguada," see Fig. 7); *g*. Water-hole near the coast, when water level is very near the surface; *h*. Fresh-water spring in a brackish lagoon or "cienaga"; *i*. Coastal sand reef on which coastal towns are located; *j*. Fresh-water spring a short distance from shore; *k*. Gulf of Mexico; *l*. Sea level.

composed rather of a series of projecting ledges apparently due to the varying hardness of the slightly northward-dipping strata. Figure 4 is a diagrammatic section of such a cenote.

The so-called Great Cenote has in reality a somewhat smaller diameter at the water surface than the other, but it appears larger because of its sloping walls. The walls are, however, except on one side, practically perpendicular for a considerable distance from the water, above which they slope back until they attain the ground level (Fig. 5). On one side there are remains of a ruined stairway; for it was this cenote which supplied the inhabitants of the ancient city of Chichen-Itza with water.

An examination of some of the other cenotes in the vicinity of Chichen-Itza and elsewhere, furnished an explanation of the mode of origin. At Pisté, a small Indian village but a short distance from Chichen-Itza, the village well, after going a few feet through solid rock, opens out into a large cavern with water at the bottom. The depth to water appears to be about the same as in the cenotes at Chichen, and, as nearly as could be judged, the diameter also approaches similar dimensions. Here, then, we apparently have a cenote which is entirely roofed over, the well above mentioned being artificial. This condition may be represented by the diagram in Figure 2.

About three miles east of Chichen is a cenote known as the Ikil. This was apparently, at one time, like that at Pisté, but the roof over the greater portion of it has fallen in, leaving at present a partial roof over two sides. Here again advantage had been taken of the overhanging roof to construct a well for drawing water. Figure 3 may be taken to represent a section of the Ikil cenote as in an intermediate stage of development in which only the central part of the roof, the top of the dome, has collapsed. There is a story that in the plaza of a certain Yucatan town a horse and rider once disappeared suddenly from sight by the breaking in of the roof of one of these subterranean caverns. Whether or not that story can be credited, Dr. Gaumer, long resident at Izamal, is authority for the fact that workmen, in digging a well at Motul, broke through the top of a great dome-shaped cavern and lost their tools. Many wells in Yucatan are thus situated over underground caverns.

There can apparently be little doubt that these peculiar water holes were formed, in the first place, by the solution of the rock, so as to make great underground dome-shaped caverns. The surface rock, as is common in limestone regions, is much harder than that below. The water therefore makes its way down through crevices in the resistant upper layer causing comparatively little solution; but when it encounters the softer strata below, its solvent power is exercised and large caverns with roofs intact are the result. In the walls of the Sacred Cenote at Chichen some of the lower strata are so soft that the rock can be crumbled in the hand almost like dust. The essentially horizontal position of the strata may be another important factor in giving the cenotes their vertical walls and few horizontal passages. The dip of the strata is so slight that it has probably been easier for the water to work its way directly down than to run off laterally. Either by the too great extension

of the cavern or by the gradual sapping of the roof, the latter eventually collapses, and the cenotes, such as have been described, are the result. One has but to witness the effects of a heavy tropical thunder storm upon the steep walls of one of these cenotes to realize how important an agent is erosion in their subsequent development; and considering the number of stones that go rolling down even during a brief storm, it seems strange that the walls are not worn back faster. They wear back first at the top, the lower part of the wall

FIG. 9—The Sacred or Sacrificial Cenote at Chichen-Itza. (Photo by E. H. Thompson.)

remaining vertical (Fig. 6); but the process of wear is continued until the cenote consists of a pool of water at the bottom of a funnel- or basin-like depression (Fig. 7). The twin cenotes of Shkolak (Xcolac) and Skashek, about two-thirds of the way from Izamal to Tunkas, would appear, according to the descriptions of Baker (1895) and Charnay (1887), to belong to this stage. In some cases the bottoms appear to have become entirely filled in, and such depressions then hold water only temporarily after rains.

The Underground Drainage

There appears to be a common belief in Yucatan that the water which sinks into the rock gathers into well defined subter-

(Fig. 10—The Great cenote at Chichen-Itza. Owing to the wearing back of the walls, the vegetation has better access to the water and is more luxuriant. (Photo by E. H. Thompson.)

ranean rivers, which in turn empty into the sea. The reasons brought forward in support of this view may be briefly summarized.*

* Many of the facts and ideas here expressed are on the authority of Dr. G. F. Gaumer, an American physician who has for many years resided in Izamal.

In the first place, it is to be noted that the water in the cenotes is fresh and sweet as a rule, and it is argued that if they were not in some way connected with underground streams it would become stagnant and foul. It should be borne in mind, however, that in many countries, even in the tropics, water is often stored in cisterns for long periods and remains reasonably sweet. Another argument is that the water level in the cenotes remains fairly constant, having only minor fluctuations corresponding with periods of rainfall and drought, showing that the waters must have a ready escape. Cases are known in which neighboring cenotes are actually connected, the connection being in some cases (as at Motul) below the surface of the water.

Boys have sometimes thrown in gourds and hats, which have later been recovered from another well. In 1900 a domestic duck fell into a well (which opens into a subterranean cavern) at Izamal, and the following day was taken out of a well some one-fourth mile to the north. Izamal is probably situated over a great subterranean river; a line of important towns can be picked out which mark its course from the southern hills to the Gulf.*

Further evidence of subterranean streams is furnished by the numerous "boiling" springs along the north coast. Many of these open into the coastal lagoon while others open out in the salt waters of the Gulf itself. This water bubbles up from the bottom of the "cienaga" through holes from 6 to 15 feet in diameter, in which the sand is constantly agitated. Ober (1884) states that a fresh water spring in the Atlantic has long been known off St. Augustine, Florida, and quotes Humboldt as follows, regarding their occurrence on the Yucatan coast:

> On the northern coast of Yucatan, at the mouth of the Rio Lagartos, 400 meters from the shore, springs of fresh water spout up from amidst the salt water. It is probable that from some strong, hydrostatical pression the fresh water, after bursting through the banks of calcareous rocks between the clefts of which it has flowed, rises above the level of the salt water.

As Ober says, Florida and Yucatan are of similar geological formation, which may account for the appearance of these springs on the coasts of both peninsulas.†

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* On the authority of Dr. Gaumer.

† Ballou ("Due South, or Cuba past and present") wrote in 1885 that much of the drinking water, and certainly the best in use at Nassau, as well as at some of the neighboring islands, was procured from fresh water springs bubbling up through the salt water. He says the same is true also on the shores of the Persian Gulf. In the former case, the water was brought to the surface through barrels filled with sand, while in the Persian Gulf divers go down with leather bags which they open over the bubbling fresh water springs at the bottom. Hitchcock (1905) mentions fresh water springs in the ocean on the volcanic shores of the Hawaiian Islands.

The coastal springs mark the mouths of underground rivers, and the villages in their vicinity are the terminal ones of the lines that mark the courses of the streams from the hills to the sea. The inhabitants of these coastal villages, in some cases, place hollow tree trunks in the holes of the sea floor through which the water gushes, thus leading it to the surface of the Gulf without commingling with the salt water. They, in this way, obtain their supply of fresh water by going out on the Gulf in canoes! During times of storm, when the Gulf is too rough for canoes, it is necessary to go inland

FIG. 11—Scene in Citas, a village 30 miles north of Chichen-Itza. Shows scanty soil and characteristic vegetation. (Photo by E. H. Thompson.)

a mile or more across the "cienaga" to get fresh water. All the towns along the north coast, except Progreso, are said to be located where these subterranean streams open.

At Ascension Bay, on the east coast of the Yucatan peninsula, one of these rivers, 30 feet wide, has its roof broken in for about a mile inland, and, for this distance, runs between vertical walls not over three feet high. This probably represents the type of drainage in all the peninsula, merely differing in the fact that the roof of the once subterranean stream has here given way.

Another noticeable fact is that in most and possibly all of the cenotes in the more northern part of the peninsula the water stands at a common level. The available data as to altitudes and depths of the cenotes to water level are so incomplete and inaccurate that a consistent table cannot at present be prepared; but the bulk of the evidence seems to indicate that, in all of those cenotes north of the

FIG. 12—Scene in front of the "hacienda" at Chichen-Itza. (Photo by E. H. Thompson.)

"sierra," the water stands at a level only a little above that of the Gulf. The land surface rises on an average of about a foot to the mile and, making allowance for local irregularities, the distance in feet from the surface to the water level, at any particular point, is approximately the distance of that place from the Gulf in miles. Thus we find that close to the coast the water lies very near the

surface. Merida is 25 miles from the coast; according to Schott (1866), and Heilprin (1892), its altitude is 28 to 30 feet, and, on the testimony of the same authors, the water in the cenotes is some 26 to 30 feet below the surface. Other striking cases of agreement might be adduced, but these will suffice to illustrate the point.

There are two ways in which we may account for the maintenance of such a condition of the karst water. Either there are connecting passages between the different cenotes below the level of the sea, or else the rock at that level is so porous that the water can traverse it easily, or there may be a combination of these two conditions. Some of the evidence for believing that these are real subterranean streams has been given above. Against such a view must

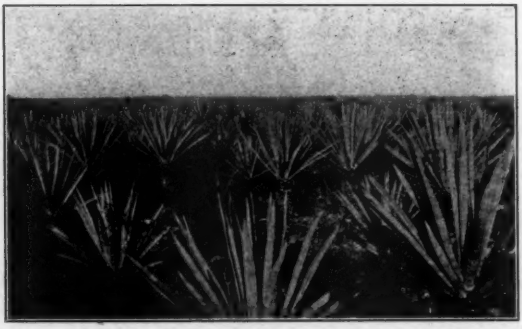

FIG. 13—Henequen plantation at San Ignacio. (Photo by L. J. Cole.)

be put the fact that in two cenotes only some three miles or so apart, entirely different species of catfishes were found living, although the general conditions seemed much the same. In one of the cenotes, however (the Sacred Cenote), the water was only 36 feet deep, while in the other (the Ikil) a sounding line was lowered to 95 feet below the water surface! Such being the case, there can be no doubt that extensive subsidence has taken place in the Yucatan peninsula since its principal drainage features were formed; for in no other way can we account for the great depth of this cenote below the level of the sea. At one time the land must have stood at least 95 feet higher than it does to-day. At that time, the drainage conditions were probably similar to those found in any ordinary limestone region, with long horizontal tunnels and caverns, some distance above sea level, and vertical shafts leading down to them. Subse-

quent subsidence carried the horizontal passages below sea level, thus gradually raising the level of the water in the vertical shafts, but maintaining practically the same height all over the peninsula.

FIG. 14—A native wheel, with buckets, for drawing water. (Photo by E. J. Thompson.)

While it is possible, then, that there exist actual underground rivers, they are in most cases more than that, for they are actually below the level of the sea as well, and are to be looked upon as connecting tunnels completely filled with water rather than as real

streams. There were, however, undoubtedly in some cases, horizontal passages at higher levels, which might not yet be entirely "drowned," and which would account for the transportation of floating objects such as hats, etc., as already described. In other cases no doubt the caving in of the roofs and the accumulation of débris has blocked the passages from many of the cenotes, the water now having to make its way out by seepage. This would account for the comparatively shallow water in some of them, and also the restricted distribution of certain species of fishes.

In the hill region the drainage system is still largely above the sea level, and it here presents the features more commonly associated with limestone caverns. Here there are more lateral passages that can be traversed, but though, here and there, water may stand in impervious pools, the lower levels appear to be practically coincident with that of the sea. In Figure 8 an attempt has been made, by a schematic north-and-south cross-section from the hill region to the Gulf, to represent the principal features of the Yucatan karst which have been so briefly outlined.

Relation of Hydrographic Conditions to People

The natural semi-aridity of northern Yucatan is accentuated by the fact that the soil covering the rock is in many places very scanty. The semi-arid quality is especially marked during the day season, when many of the trees lose their leaves and the general appearance of the forests reminds one strongly of our own forests in early spring or late fall; and many of the native birds migrate to the southward from the peninsula, just as many of our birds go south (some of them to Yucatan) during the winter months.* The failure of the soil to retain moisture also limits very closely the kinds of crops that can be cultivated successfully. It is true that during the rainy season many garden crops may be grown successfully, but the two most important products of the country are corn and henequen. Sugar cane is cultivated to some extent. The raising of cattle is limited by the scarcity of forage, while the leaves of certain trees have to be gathered for the horses in place of hay.†

As to the corn and henequen, the former is all consumed in the country, the latter is practically all exported as the crude fiber. The method of raising corn employed by the natives is dependent upon

* Some evidence for such a migration has been presented by the author (Cole, 1906, p. 112) in the introduction to a paper on the birds of Yucatan.

† The stock can be turned loose and does not have to be herded during the day. It cannot get to the water in the cenotes, and consequently has to return to the tanks in the corral.

the weather conditions, and is very impoverishing to the soil. At the close of the dry season, the Indian prepares his "milpa" or cornfield by burning the timber from a tract of land, which is then planted in corn when the rains begin. A good crop is dependent upon plenty of rain. Corn is the staple food and a scarcity of this cereal, due to a bad season, is a serious matter to those living at a distance from the towns.

Henequen is grown on the dry, deforested plains, especially of the northwestern section. It is the staple product of the country, and the demand for it, created by the shutting off of the supply of manila fiber from the Philippines during the Spanish-American war, returned princely fortunes to the class of Yucatecans who own the enormous henequen plantations. As a consequence Merida is a city of life and gaiety, and has been referred to as the Paris of America.

There seems to be no evidence for believing that the climatic conditions in Yucatan were any different at the time the Maya civilization was at its height than they are to-day, and it seems remarkable that so high a state of culture and civilization should have arisen under conditions which seem in many ways so unfavorable.

Although it is believed that the ancient Mayas built reservoirs for the storage of water, they apparently did not know how to dig wells to obtain it. It is accordingly found that all their important cities were situated where there was access to the aguadas and cenotes, or to the caverns of the hills, the floors of some of which have been worn smooth by the generations of bare feet that have gone down into their depths and toiled back with the day's supply of water. Mention has been made of the fact that, on the northern coast, the villages are located in intimate relation to the supplies of fresh water. With the advent of the Spaniard came a knowledge of well digging. It is said that good water may be obtained by sinking a well almost anywhere. In ancient times the water was brought up by hand; later it was drawn from the wells by ropes and buckets; and sometimes, at the deeper wells mules were employed for hauling it up; but now windmills have been introduced, and as there is usually plenty of wind, these do the work economically and well. The city of Merida and vicinity is, when viewed from a slight elevation, a veritable forest of steel windmills of American make.

The dry climate of Yucatan, with its cool nights, has a decided influence on the conditions affecting health. It is much healthier

than most countries lying so well within the tropics, and lacks almost entirely the terrors of the "tierra caliente" of Mexico proper. Yellow fever is endemic, it is true, but apparently has seldom or never been very prevalent, and Casares (1906) is authority for the statement that it has now "been almost completely expelled." The fishes in the cenotes and larger pools keep the mosquito larvæ largely exterminated there, and a little systematic effort would do much to exterminate them in the temporary pools of water which are held in hollows in the rock for a few days after a rain, and which are quickly taken advantage of as breeding sites by the mosquitoes. In certain regions, where there are open aguadas, malaria and dengue fever are a serious menace, especially to foreigners; but here, also, a consistent crusade against the mosquitoes would undoubtedly better conditions. This should be comparatively easy in a karst country where the greater part of the water quickly disappears underground.

Literature

Baker, Frank C. 1895.—A Naturalist in Mexico, being a visit to Cuba, Northern Yucatan, and Mexico. Chicago, 145 pp.

Ballou, Maturin M. 1885.—Due South, or Cuba Past and Present. Houghton, Mifflin and Co., Boston and New York, 8°, ix + 316 pp.

Charnay, Désiré. 1887.—The Ancient Cities of the New World. Being voyages and explorations in Mexico and Central America from 1857-1882. Translated from the French. New York, xiv + 514 pp.

Casares, David. 1906.—A Notice of Yucatan, with some remarks on its water supply. *Proc.* Amer. Antiquarian Soc. for 1905, new ser., vol. 17, pp. 207-230.

Cole, Leon J. 1906.—Aves. In "Vertebrata from Yucatan," by Leon J. Cole, Glover M. Allen, and Thomas Barbour. *Bull.* Mus. Com. Zoöl., vol. 50, No. 5, pp. 101-159, pls. 1 & 2.

Heilprin, Angelo. 1892.—Geological Researches in Yucatan. Proc. *Phil.* Acad. Nat. Sci. for 1891, pp. 136-158.

Hitchcock, C. H. 1905.—Freshwater Springs in the Ocean. *Pop. Sci. Mon.*, vol. 57, No. 8, pp. 673-683.

Ober, Frederick A. 1884.—Travels in Mexico and Life Among the Mexicans. Boston, 672 pp.

Schott, Arthur. 1866.—Die Küstenbildung des nordlichen Yucatan. *Pet. Geog. Mitt.*, vol. 12, pp. 127-130.

UNDERGROUND ICE IN NORTHERN ALASKA*

BY

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Three boat journeys of some 150 miles each through the delta of the Mackenzie River have shown no case of ice outcropping in the cut banks of the alluvial islands; neither have various winter trips through the same territory and eastward to Cape Brown revealed the presence of underground ice. That it does not occur in any of the exposed banks cannot be safely inferred, however, for it is often inconvenient to follow the land closely when travelling by sea or along wide rivers. Snow or talus may cover one month what would be visible the next. West of Herschel Island, underground ice is more frequently seen and the most casual observer can hardly avoid noticing the frequent and conspicuous outcroppings along the mainland coast and island chains from Flaxman Island west to Wainwright Inlet, the western limit of the writer's observations.

Everywhere along this stretch, perpetual frost is near the surface of the ground even in late summer. The distance down to it, at the end of August, varies (where the sun has free access) from 4 inches on level, damp, moss-covered flats to 2½ or 3 feet on sandbars that are dry and favorably located. Most years, the deepest snowdrifts on the north side of sloping hills will disappear completely, but some remnants of the larger ones persist, as many did the past summer (1908). In deep ravines, snow or ice frequently last through from year to year, even near sea level, though according to the Eskimo, an exceptionally rainy summer occasionally carries off drifts that have lain for five or more years.

The appearance of the outcropping ice is various, whether it occur along the seashore or in river banks, but in 3 things it seems to agree: there are no large, continuous ice sheets; the ice probably nowhere attains a great thickness; the earth on top of the ice is seldom if ever thick. The greatest thickness observed is less than 8 feet, while the average thickness of the surface layer is not over 2½ feet.

A sled trip in late September and early October, 1908, from the

* The observations that are the basis of this paper were made, at various times, between July, 1906, and February, 1909.

bottom of Smith Bay to Flaxman Island gave opportunity for observing ice outcroppings along the arctic shore. Probably half of this coastline consists of vertical banks which the sea is, in many places, rapidly undercutting and wearing away and these we had to follow closely, as the sea ice was not yet strong enough to allow our cutting across the small bays. There were 3 or 4 inches of snow on the ground and it was nowhere banked against the land so as to hide the face of the cliff from view.*

In many places one may follow a cut bank for miles without seeing underground ice and then come upon it without warning given by a change in the height of the bank, character of the earth, or the trend or appearance of the coastline. There may be one, two or a few pieces of ice exposed in cross section, or much of it may extend for rods and miles; sometimes the ice is high enough in the

FIG. 1—*a*, *b*, *c*, ice outcropping from an alluvial bank, about 8 feet high, near Cape Halkett. Base of *a* and *b* not visible. *d*, water level; no beach.

bank to have its base exposed; sometimes the ice face extends down beneath the beach or water line. Sometimes the ice is so nearly continuous and so nearly of even height in the bank that it seems not impossible that the breaks in it may have been produced by rivulet erosion. But if that be the case, the rivulets have been so completely filled with earth that there is now no trace of them in a uniform cut bank.

What comes as near, as anything I know, to being a continuous ice sheet,† 4 or 5 miles in extent, is found running north along the beach from Wainwright Inlet. Unfortunately, my own observations here are of little value as I have visited the locality only in midwinter. I must depend, for a description, upon the U. S. Government teacher at this place, Mr. J. E. Sinclair. Ice is also exposed near the Government coal mine on the Inlet itself, some six miles away; of this I present a diagram drawn by Mr. Sinclair.

Along the sea beach the ice is exposed so continuously that it had impressed Mr. Sinclair as a continuous sheet, cut here and there

* The cut bank varies in height from 5 to perhaps 20 feet. The highest are those east of Smith Bay.
† See discussion further on of ice house dug into this "sheet" of ice.

by small ravines, and covered in many places by talus. Where the base of the ice was exposed its thickness was nowhere over 9 feet, while at others it was only 3 feet.

In three localities, known to the writer, deep artificial excavations have been made into or through underground ice—at Flaxman Island, Point Barrow and Wainwright Inlet.

At Flaxman Island an ice house, for cold storage of food was dug on level tundra. The island is low and fairly level, probably nowhere rising much over 20 feet above the sea; perhaps a fifth or sixth of its surface is now covered with fresh water ponds. Small stones and some good-sized boulders are found on the surface, sometimes directly above beach outcrops of underground ice.

The excavation of the ice house was first through over 2 feet of soil and then through 6 feet of ice. This ice had grains of sand in

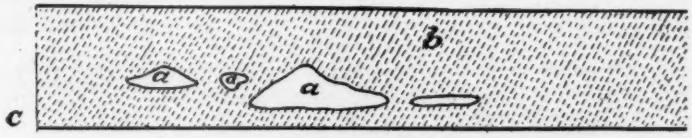

FIG. 2—Section of a cut bank, 12-15 feet high. Bank (*b*) composed of peat mixed with earth. *a*, *a*, *a*, ice apparently free from earthy impurities. Largest piece has a horizontal exposure of 12 feet and a vertical height of 5 feet.

it and fragments of rock, some rather larger than a coffee bean. Below the ice the excavation was continued a foot or two into earth of a similar character to that above the ice.*

At Cape Smythe, near Point Barrow, where an ice house was dug, the excavation was some 10 feet deep and was through earth except in one corner where a block of ice was so situated that rather less than one-fourth of the ice house is dug in ice.

The general character of the other ice houses at Cape Smythe is similar to that just mentioned, though some of the excavations answer fairly well the below detailed description of the Government ice house at Wainwright. Others, dug near ice houses in ice, show no sign of anything but sand or gravel. The deepest excavation is that dug by Lieut. Ray's expedition to a depth of over thirty feet. In the walls of this no signs of ice are found. An interesting feature of this shaft is that 3 feet of salt water stood unfrozen in its bottom for years, while six feet above, the cold was intense enough

* This description is admittedly loose. It is taken from a verbal account by one of the workmen who dug the ice house.

to keep deer meat continually frozen summer after summer. This shaft is about 100 yards from the ocean beach, while the surface of the water in the bottom of it seems to be a little below the level of low tide. The gradual drying of the walls and the resulting crumbling of the sand have filled the bottom of the shaft.

The general surface characters of the land around Cape Smythe are much the same as those of Flaxman Island—level land only a few feet above sea level.

Near the U. S. Government school, two miles north of Wainwright Inlet, an ice house was dug through about 3 feet of earth and 7 or 8 feet into the ice. A hole three feet deep at the bottom of this ice house failed to penetrate the ice, so this gives a thickness of something over 11 feet—the greatest ascertained thickness known to the writer.

The appearance of the walls of this ice house is characteristic and, in my belief, typical of much of the ice that outcrops upon the

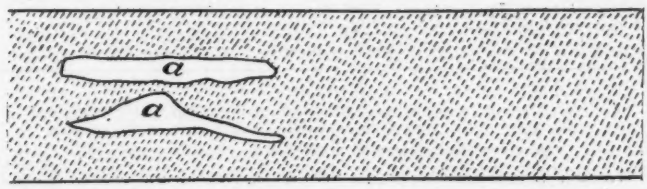

FIG. 3—Ice outcropping in alluvial cut bank near Pitt Point. *a*, *a*, ice worn level with face of bank. Upper piece about 15 feet long and 20–24 inches thick. *b* is beach level.

seashore. It should be solid ice, and ice of one kind generally, if it had been formed and frozen in its present position, but the fact is that it presents the appearance of a heap of fragments and blocks, of varying size pressed together. Neither are these fragments similar. They differ in some being "clean" ice and some "dirty;" they differ in color where they are apparently formed out of clean (not muddy) water; some are transparent, others milky; some of the dirty ice is discolored by foreign materials (muddy water ice), while some has clear layers alternating with discolored layers in a sort of stratification. Even these last may be re-classified into two groups—those which have their dark bands composed of "muddy water ice" and those in which the dark bands are not ice at all but earth—sometimes sand, sometimes peat.

Even a rough sketch of one of the walls of the Wainwright ice house gives a better idea of the character of the ice than would much

description. In some places, it seems as if smaller pieces of ice had been fused into larger ones by thawing, pressure and re-freezing. Some pieces seem to have been thin and to have been crumpled (not crushed) by lateral pressure so that their position in the ice wall is now indicated by wavy lines. And between and among all these heterogeneous ice blocks are fragments, layers and huge masses of earth. Here and there, also, are corners and crevices packed solid with snow, not large quantities, but a thimbleful here and a handful there. In some places this snow has been pressed and water-soaked so that it differs little from the rest of the wall in hardness; in others it is so soft as to be easily scratched with the fingernail.

Some of the thinner layers of earth in the wall of this ice house are sand and others peat, but the larger masses are entirely of fine sand. While some of these look as if they might have been in their

FIG. 4—Ice and coal outcropping at Government coal mine, Wainwright Inlet. *a*, *a*, hill slopes covered with grass and moss. *b*, clay and gravel talus. *c*, *c*, ice about 8 feet thick. *e*, blue clay. *f*, lignite, 4½ feet. *g*, sub-bituminous coal, 2½ feet. *h*, high water mark. The ice extends below the level of the beach.

present form at the time the ice was heaped up around them, others suggest that thin mud flowed into empty spaces, between loosely piled ice blocks, and froze there.

In several places, the ice house walls show frost cracks such as are found everywhere in frozen ground, but these are easily distinguished from the typical thin mud layers in the ice wall by the fact that the frost cracks are straight or harshly angular, in distinction to the flowing curves of the others, which suggest that they were formed by wind or water action.

The ice houses of Eskimos living at Wainwright show, in general, characters similar to those found in the Government ice house. One of them, though larger than the Government ice-house, shows no large masses of earth in the walls or floor, though the thin mud layers streak the walls here and there. In one corner, however, a significant thing is observable—an open space where none of four ice blocks had touched each other but had left a small pyramid-shaped chamber to which neither water, snow or sand had found access, evidence, apparently, that the pressure under which the ice was heaped was not strong enough to close all crevices.

It remains to outline four different processes by which the writer has seen underground ice formed. That there are other methods by which it is formed in this locality seems probable; that remote localities and remote times may have had others seems still more likely.

FORMATION OF UNDERGROUND ICE ALONG THE SEASHORE THROUGH WIND PRESSURE. Along a gravel beach running from Cape Smythe towards Point Barrow there were, in the summer of 1908, a number of mounds, the largest rising 12 or 15 feet above their base level

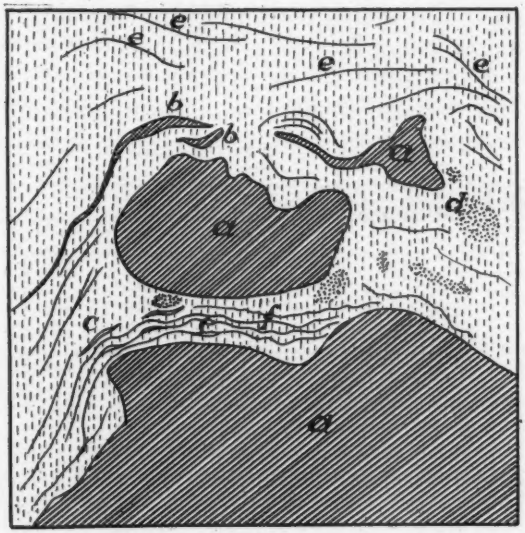

FIG. 5—Sketch of part of east wall (6 ft. by 6 ft.) of Government ice house, Wainwright. The vertical broken lines represent ice. *a*, *a*, *a*, masses of earth. *b*, *b*, sand with laminæ of ice between. *c*, *c*, pockets of sand. *d*, masses of snow, here and there, more or less compressed and some solidified into ice. *e*, thin layers of sand or peat. The ice at *f* seems to have been subjected to strong lateral pressure, hence the wavy lines.

and with a basal circumference of say 50 feet. Some were a considerable distance apart, others touched each other and formed a sort of double or treble mound. Scratching into these heaps with a stick showed that the main body of them was ice, with a covering of gravel. Tongues of ice had been thrust into the land. When the tide fell and the water retreated the main body of the ice broke away, leaving pieces, weighing tens of tons, in some cases, imbedded in the ground. It is probable, because of the thinness and porosity

of the gravel and the consequent penetration through it of every summer shower, that even the largest of these ice blocks will disappear in a few years and the beach resume approximately its former appearance.*

A gravel and ice hill similar to those just described is situated on the north coast about half way from Smith Bay to Cape Halkett. This hill, an Eskimo told me, was there six years ago and has not decreased noticeably in size. At the eastern entrance to Smith Bay

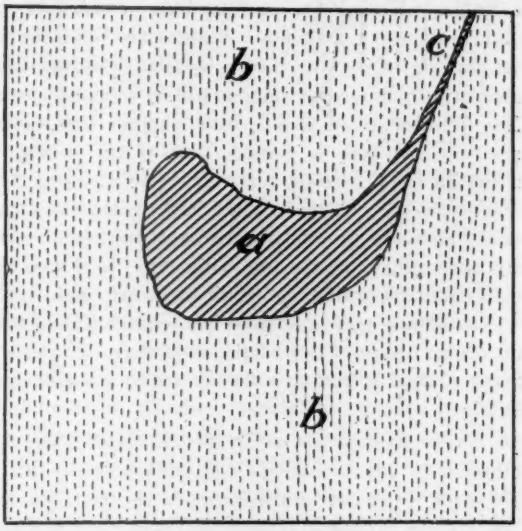

FIG. 6—Part of west wall of Government ice house at Wainwright. *a*, mass of mud that seems to have flowed into a cavity in the ice and frozen there. *b*, *b*, clear ice. *c*, crack through which mud flowed in?

are two similar heaps, but covered with peat instead of gravel. That their core is ice is merely inferential, for their outside was frozen hard. In my observation, 5 or 6 inches of wet peat will keep ice from melting through an ordinary summer. A foot or 14 inches of damp mud would serve the same purpose, though dry sand thaws down deeper. A typical ice block shoved in, as described above, would carry in with it not only dry snow but snow soaked with sea spray and frozen, while in the very centre of a cake might be found

* Some, apparently, persisted in former times, however, for the ice-house dug in the spring of 1908, of the Cape Smythe Whaling and Trading Co. was excavated through gravel mixed with boulders of ice evidently formed in muddy water, such as is formed in autumn along the beach when a southwest gale heaps muddy slush-ice in the shore water.

snow similarly frozen by a submergence, by pressure, of the ice cake while it was out at sea.

Preservation of Sea Ice Under Mud Deposited by Rivers. At the mouths of most arctic rivers, the sea is so shoal that it freezes to the bottom for a greater or less distance from shore. Sometimes the river, especially if one of considerable size, has an open channel to deep water somewhere all winter, but that does not alter the fact of there being much bottom-frozen ice near the river mouth. If the entire stream freezes to bottom we have winter overflows and water (muddy or clear) may flow at any time out over the older ice, so that the ice of a river, in cross section, shows, by spring, many layers of ice, now of muddier water, now of clearer, with more or less of snow-ice between. But whether this flooding happens or not, one overflow is certain, that of the spring break-up when the muddy river spreads for miles over the sea-ice near its delta. I have seen the mud layer deposited by the water, as it loses its current at the river's mouth, thick enough to preserve ice several inches thick into autumn of the following year; with favorable conditions, it seems that a thin ice layer of one year might be added to by a thin layer of the next, and thus ice deltas be formed much as mud deltas are in rivers. In certain shoal bays it seems not impossible that the muddy overwash by the sea in a storm might have a like effect.

Ice and Snow Preserved by Drifting Sand. On the Jones Islands (miscalled "Thetis Islands" on some charts) just east of the Colville delta, I found, in the summer of 1907, ice and snow under a few inches of damp sand. This was late in July, but it seemed to me evident that the snow and ice had been there more than one season. When the wind blew hard, sand drifted considerably on those islands and formed small dunes in places; judging from the dirtiness of the snow, at a considerable distance from the island, this winter (1908-9), it seems that sand drifts there to some extent at all seasons, so that a snowbank might get a considerable coating before spring and a much thicker one before the summer sun had thawed even the unprotected drifts near it. The drifting of sand and dust from the mud and sand bars at the mouths of rivers upon the ice near them is also a contributing factor in furnishing a preservative coat to the ice that sometimes persists there throughout the summer.

Ice Preserved by the Shifting of Channel of a Meandering River. In the banks of the Colville, there may be found ice out-

croppings, at least 25 to 40 miles from the river's mouth. This ice may have been formed and preserved as already indicated, but as ice benches along cut banks are frequently maintained late into the summer, even in locations not particularly favorable, and as sand bars are often piled up with astonishing rapidity in the arctic rivers, it seems not unlikely that one of these benches should now and then be covered with sand or mud sufficiently deep to preserve it indefinitely. Incidentally it may be suggested that the carcass of an animal (*e. g.*, a mammoth) would, in like manner, be indefinitely preserved if the beast were to die at the growing end of a sandbar in a river whose channel is shifting across a roomy floodplain.

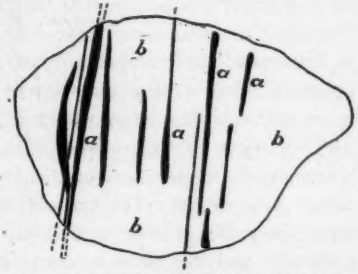

FIG. 7—A piece of ice chipped from wall of Government ice house at Wainwright. Half natural size. *a*, black earth of peat-like character. *b*, ice.

Finally, it may be noted that, both along the arctic coast and on the north flowing rivers, the comparatively warm water undercuts the vertical banks in numerous places. For this reason huge blocks tumble down every now and then. It might be supposed that these would fall down in summer invariably, on account of the undercutting at that season and the thawing of the ground. As a matter of fact, the thawing of a few inches on the surface makes little difference and the rapid undercutting may be credited with the fall of such banks as do fall. In winter, however, a sharp frost or sudden change of temperature often causes the earth to crack to a great depth.* If one of these cracks happens to be suitably located, it cuts off the projecting bank and it may tumble upon the ice below in mid winter. If other conditions are suitable, this huge bulk may protect the ice under it from melting, but it is of course more usual that the river or sea, the next summer, breaks up the mass and carries it away.

On Herschel Island, where, by the way, no underground ice has been found in digging numerous ice houses, and where none is known to outcrop, landslides frequently bury snowbanks and ice shelfs at the foot of a cliff, but this preserves them only a year or two, for, along the steep cliffs, the shoreline is continually receding.

* The writer has seen frost cracks in the mudflats of the Colville that are a hundred and more yards long, and wide enough so that a man occasionally stumbles by his foot slipping into them through the snow.

THE DEVELOPMENT OF COMMERCIAL CENTERS

BY

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Cities and trade are continually exerting reflex influence, the one upon the other, and to understand the large commercial movements, we must understand the economic functions and origins of the city.

The origin of the town goes back into the early history of the human race, to the days of the first permanent settlements and the first regular trade. The present day metropolis is but a town grown large, and the growth is a result of its trade and the same laws govern it and the same forces push it from its village beginning to its metropolitan ending.

The beginning of commerce is a trade or barter between two individuals. Each has a surplus of a particular article and they find mutual advantage in the exchange of the surplus. The most complex phases of present day commerce are but the outgrowths of this simple exchange of goods, complicated by the numberless wants of man, the variety in natural resources, the world-wide distribution of industry, and the myriad complexities of invention and manufacture.

The rise from barter to money and the expansion of trade to international proportions have produced many institutions. First and most fundamental among these is the trade center or distributing center. In primitive barter man develops so many wants that it becomes inconvenient to meet individually the various people with whom he wishes to trade, and some common meeting place is the result. Many previously disconnected individuals now have a place for common activity, some of them a place for common residence, and a market place, or fair, a village or town comes slowly into being. It is interesting to note, in this connection, that in many European cities this primeval plot of ground where the trading took place continues to this day as a market square, as in Antwerp, Brussels and many other cities now grown great. It is also to be found in many a small country town. The normal trading town is, therefore, manifestly and most naturally located in some spot easy of access, some spot with a natural superiority of access usually due to geographic causes. If these conditions of superiority of access are sufficiently far-reaching the settlement around this market place

becomes a city with international trade, for the market village and the metropolis are alike the products of economic forces that differ only in scope, not in kind.

In examining into the causes for the growth of commercial centers, one should note the distinction between industrial and commercial causes, between industrial and commercial cities. Examination shows that most cities have both commerce and industry in some degree. As a commercial city increases in population some local industries usually spring up. And similarly the growth of a manufacturing city usually develops some commercial activity. The mere numbers of people inevitably produce at least a certain minimum of trade and manufacture. But in the main, the city exists because it is either a commercial or an industrial center, the one activity being only secondary or tributary to the main one. In most cases it is easy to characterise the world's leading cities as belonging to one or the other of these classes. For example, Pittsburg, Pa., Birmingham, England and Lyons, France, will be classed at once as industrial cities. New York, Liverpool, Hamburg, and Hong Kong will be classed as commercial cities. The purest examples of commercial cities are to be met within the unhealthy seaports of the torrid zone where the conditions of life are so bad that only the most compelling of operations are there performed. Such a city is Santos, Brazil, or Puerto Cabello, or La Guayra, Venezuela. Here are centered the strictly port or commercial activities that must be by the water edge while in the much larger cities of São Paulo, on the wholesome plateau near Santos, and Caracas similarly situated near the Venezuelan ports, the manufacturing and residential functions are centered.

In other cities the commercial and manufacturing influences become difficult or even impossible of accurate discernment because political reasons have interfered with, or been added to the workings of economic forces. Where several cities have approximately equal natural advantages, the selection of one of them for a national, state or county capital will be the deciding factor that raises it far above its rivals. This force has made Paris and Berlin the great cities that they are, and the City of Washington, in a location fixed by statute and having neither manufactures or commerce, exists because it is the place of residence for the thousands employed in the administration of the Federal Government of a rapidly growing nation.

The commercial city or distributing center, its causes, and some

of the influences affecting it will be considered here. The industrial center and the political center will only receive attention as they bear upon commercial questions. At the present time, students, publicists, and lawmakers are devoting much attention to commerce. It is necessary that there should be a clear understanding of the way in which commerce, and particularly international commerce, is carried on and why it is carried on in certain cities. Without such an understanding, legislation in favor of commerce must sometimes miss its goal and expenditures for the promotion of trade must sometimes be made without results.

Some advantage in transportation is the most fundamental and most important of the causes determining the location of a distributing center. It may almost be said to be the only cause for the formation of such centers. For some reason, a particular place is more conveniently and cheaply reached by many people than any surrounding point and, as a result, they naturally exchange commodities there. The country store is located at the crossing of roads. There also is the village. In a mountain country the market town is at the junction of two, or, still better, of three valleys. Another favorite location is the end of a mountain pass or gap that is a thoroughfare between two valleys. If rivers are difficult to cross, a settlement will spring up at the safest ferries or fords. In a level plain, a town will be near its center, and a focus of roads or railroads in such a plain, fertile and populous, will almost surely make a city. Any one who is familiar with the geography of a country district can see examples illustrating any or all of these. The head of navigation on a river is a location far more commanding than any of those already mentioned. Here all the trade that goes by the river must be changed from one method of conveyance to another. Here goods are collected from the surrounding country for shipment by water. Here the people, who bring the goods, buy their supplies. Here also must be merchants, forwarding agents, and the repairers of wagons and ships. A town or even a city arises. It is interesting to note that towns of this class were relatively much more important in 1800 than in 1900. In the first-named year a river offered a much greater relative advantage for cheap transportation. Without water transport but few localities could support populous settlements. The alternative was the creaking and heavy wagon miring in the mud. The cost of carrying goods by wagon was so great that in a short distance it equalled the value of the goods and set a narrow limit to the territories that could engage in commerce. A navigable river gave its

valley an outlet to the sea, and the river port was a close rival in importance to the seaport. In 1900 the railroad carried most of the freight which 100 years before depended upon the river. As a result, many places of leading importance in 1800 had in 1900 become insignificant towns. The new means of transportation, namely, the railroad, have built up prosperous cities where under the old conditions cities were impossible. Examples of this shrunken importance may be found in abundance in the basin of the Chesapeake. With its many estuaries there were numerous ports of nearly equal size in 1800, when George Washington's Alexandria was an important and prosperous place. But Baltimore has long been the seaport of the Chesapeake, and Alexandria would not now make a good ward in the rival that serves her by rail with many sea-borne products.

The loss of the river port has been the gain of the sea port. The railroad train has rushed past the river port to the giant ocean steamer that cannot reach it. The most commanding location is the safe harbor which is, or may become, the natural outlet for a rich and populous territory. It has in greater degree and in greater extent the advantage that is to be found in the location of all the smaller distributing centers that have been cited above. It is a convenient place for the breaking of cargo. It is the extreme point that can be reached by the most favorable means of transportation and one where operations must begin on a smaller scale and by a more expensive method. Here the ocean steamer discharges its freight which is taken forward to its destination by smaller and more expensive carrying agents—the coasting vessel, the river boat, the railroad, and to some extent the wagon, and in some countries, even the pack train. The great sea port exists because it is a place for the breaking of cargo by ships, just as the country store exists because the wagon loads of miscellaneous supplies must there be divided up into numerous small packages for the individual consumer.

Sea ports are the focusing points of the commerce of both land and sea. Nearly all land commerce and land routes go to and fro between ports and interior points. All ocean commerce is a movement of ships and goods from port to port. What is a port, what makes a port? Any place where ships can unload, in safety, their goods upon the land may become a port, but such places actually do become ports because of their location with relation to adjacent, accessible seats of human enterprise. They rarely become ports because of any production within the port itself. The activity of

the port begins primarily because it has particular advantages of access to populous regions and also suitable access to the sea over which the commerce of the regions is to go.

It must be a point as far inland as possible so that the importer and exporter may have the largest advantage of the cheaper freights possible on large ships. Therefore the greater ports are at the heads of bays and gulfs rather than on peninsulas and headlands. The rugged west coast of Great Britain offers many bays and harbors for the shelter of shipping, but none of the small ports on projecting Cornwall can displace Bristol as the leading harbor of the southwest of England, for Bristol is far inland at the head of a bay. In the same way Liverpool, the great port of the west, has grown upon the indented coast of Lancashire, and not on some of the equally safe bays of the projecting coast of Wales. Similarly, Boston and New York are on bays that indent the main land, not on those near the end of Cape Cod or Long Island.

Besides easy access from the sea, the great seaport, the international trade center, must have easy access to the land and to the centers of population that it serves. This access is best supplied by a navigable river where there is also easy land communication over a level valley, besides the water transportation on the river itself, and on the canals that can be built most easily along water courses. Nearly all important seaports are at, or near, the mouths of rivers, navigable or otherwise, and in regions having navigable rivers the largest cities are in locations having the best communication with the interior. New Orleans, on the lower Mississippi, has been, from its settlement, the unrivalled metropolis of the coasts of the Gulf of Mexico. Philadelphia, Boston and Baltimore were the rivals of New York till the opening of the Erie Canal made the Hudson the outlet for the Great Lakes and of enormous territory in the center of the continent. With this advantage New York has gained a foreign trade exceeding that of all the other Atlantic ports combined. If the break in the Appalachians had been at the navigable head of the Delaware, the Susquehanna, or the James, the location of our great commercial metropolis would surely have been different. The improvement of the railway and the cheapening of rates have caused the Erie Canal to carry a declining proportion of New York commerce, but the level country through which the canal passes is also the most favorable for the building and operation of railroads. As in America, so in other continents the navigable river has dominated the growth of seaports. It is not by accident

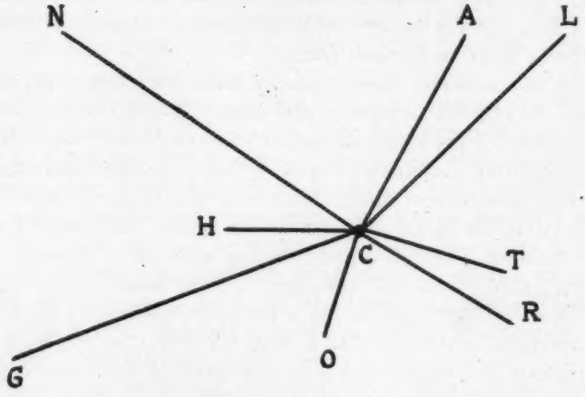
that London and Liverpool are upon the Thames and the Mersey with their canal connections with the interior. Hamburg has outstripped Bremen because the Elbe is navigable beyond the Austrian boundary, while the Weser gives Bremen but inferior communication with the "hinterland." The Nile has made Alexandria: the Ganges, Calcutta: the Yangtse Kiang, Shanghai; and Hong Kong, the island distributer for South China, lies directly at the mouth of the West River, the great highway of the southern provinces.

Some ports have a twofold commerce. Besides commanding the regions lying inland they are able to distribute, by sea, foreign goods to other ports or even to the ports of foreign countries. This is an important element in the growth of many cities, but a greater impetus in the development of seaports of the first magnitude comes from a large producing and consuming inland region that must use these cities as an outlet and inlet.

Being the distributing and supply point for such a region, the port has an excellent supply of raw materials, and becomes a favorable location for the establishment of manufactures. This is especially true of those industries requiring imported raw materials. To industrial development along this line is due a large share of the growth of all the larger seaports of the world. In addition to and distinct from this incoming and outgoing trade of the dependent and industrial districts, is the commerce of the second kind, the distribution of foreign goods to other foreign countries. Thus London and Liverpool, in the past, had a large commerce in articles that did not originate in England and were not intended for consumption in England. London was the largest distributer of foreign goods. The London merchant was a middleman in international commerce. Consequently, England gained in riches from this source, but the chief reason for the growth and prosperity of London was not her foreign distributing trade, but the commerce that came to her as the local center of a great industrial population and the commercial capital of the country where the most highly developed manufactures in the world fostered the largest import and export trade. The chief basis of a city's trade under modern commercial conditions is to be found in the industrial districts of which that city is the immediate distributer, and not in the business that comes to a city as a commercial intermediary. This intermediary, or distributing trade, national or international, is the second step in the development of a city. The first step is the establishment of many lines of transportation giving connection with the various countries engaging in

international trade. These are only built up and in the main supported by local demand and local production.

In the diagram let C represent a commercial city that succeeded in establishing direct connections with the scattered cities H, O, R, & T, and L, A, N, & G, because the industrial districts around C could in part at least consume the exports and supply the imports of these outlying regions. Once these lines of transit were in operation, it was found that the consumers of G wanted small quantities of the goods produced in T, A, or R, and that the people of T, A, and H wanted the products of G. This trade was small, and the cheapest way to carry it on was through the existing connections, via the center C, which in time became the emporium whence the



products of G and N were supplied to all the other countries, and whence G and N imported the assembled products of many lands.

This may look like wasteful method with useless travel, but the movement of goods may be in such small quantities that it would not furnish sufficient cargo to justify sending a ship from G to N. Such roundabout commerce is taking place to-day and has been taking place since commerce began. There are many places about the Gulf of Mexico and the Caribbean Sea that within recent years had so little commerce and hence so little transport connection with each other that the most convenient way for a traveller or freight to get from one to the other was to go via Europe or the United States. This has even been true between the neighboring islands of Cuba and Jamaica or Cuba and Porto Rico.

For C one may substitute, according to the period of which he

speaks, Venice, Bruges, Antwerp, Amsterdam, London, and to a lesser degree, New York. It will be observed that each of these cities was the metropolis of a dense industrial population and had important commercial activities of its own before it rose to the point of controlling the commerce of other countries.

One of the changes in the world commerce of the past century has been the pronounced separation of ports into classes. One class is the raw material port, and another is the manufactured goods port. The two are steadily growing more distinct at the present time. This has resulted from the vast multiplication of commerce in bulk which multiplication is in turn the result of the numerous industrial changes of the past hundred years that have come from the application of steam and electricity to so many of man's activities. World commerce has been made over in more ways than mere vehicles and means of propulsion and management. Its commodities have come down from the small bulk and high value goods such as tea, silk, furs, spices and luxuries to the cheap and bulky raw materials—grain, lumber, petroleum, ore, and the coarser fibers. Spices have gone to the tenth place even in the exports of India, but we use more of them than ever.

The filling of the channels of trade with the many bulky, cheap or perishable articles has produced new trade conditions with less dependence upon great ports and distributing centers. Cheap and bulky goods usually go to best advantage in full cargo lots, and as the vessel has to depend upon no other freight, it can load at any small port near the place of production. It is easy and profitable for a vessel to go to a small port of Florida or Georgia for a full cargo of phosphate or lumber, to a Chilean outport for nitrate of soda, to a West Indian outport for iron ore or bananas, to Cardiff, Wales, for coal, or to a convenient railway terminus in the Argentine Republic, for wheat.

A railway, a pier, and suitable warehouses may enable a small town to export raw material in bulk. The raw material port therefore may be, and usually is, a small port.

These goods may also be imported by a small port for use in local industries that do not require a large population for the manufacture and distribution of the products.

It may therefore be stated that trade in raw materials has a stronger tendency than manufactures to go direct rather than via intermediate ports and may often be exchanged between cities of small importance. In contrast to this, it is only a large city that

can import or export cargoes of highly manufactured goods. These articles are consumed in small quantities. Much choice is exercised in their selection and purchase by the consumer. The retail dealer must exercise similar care and discretion in the selection of his stock. He can do this best in a great wholesale market where he can go from place to place and take advantage of the competition and stock of many wholesale merchants. This is to be found only in a great city. This gives the city holding the trade in manufactured goods the conservative force that comes of its being known as a market. The trade in manufactured goods therefore continues to cling to the older distributing centers long after it is possible to make direct shipments.

The 19th century development has been not so much a revolution as a new growth. The old commerce of 1800, the trade in manufactures, spices and luxuries stays, much augmented, in the old centers, and the new commerce, in bulky raw materials, goes directly between small ports. This gives to the trade of almost all ports a one-sided characteristic which has a profound influence upon the ocean carrying trade. The greater number of the world's ports are either importing or exporting ports, but rarely are both of these activities centered in one port in anything like equal amounts. This is shown by an examination of this table which shows, for a recent year, the commerce of selected ports of the United States and United Kingdom, the value of imports and exports and the percentages that these bear to the whole movement of the nation.

	IMPORTS.		EXPORTS.	
	TOTAL VALUE MILLIONS.	PER CT. TOTAL U. S. OR U. K.	TOTAL VALUE MILLIONS.	PER CT. TOTAL U. S. OR U. K.
New York	$688	57.6	....	....
Boston	93	7.8	96	5.1
New Orleans	42	3.5	159	8.5
Galveston	5	.4	161	8.6
San Francisco	48	4.0	28	1.5
Puget Sound	22	1.8	44	2.3
London	£209	32.4	£123	23.7
Liverpool	160	24.8	165	31.1
Glasgow	15	2.3	30	.5
Plymouth	1.5	.2	.17	.03
Belfast	8.1	1.2	2.4	.4
Dublin	2.7	.4	.1	.01
Dundee	5.7	.8	.9	.1

New York and Boston, the leading Atlantic ports, adjacent to the greatest centers of population and manufacture are the cities with the oldest and best ocean connections. They are the leading ports of import and their percentages of imports exceed their export percentages. San Francisco, the old gateway for imports across the Pacific, has a still greater excess of imports and is in interesting contrast to the newer Puget Sound ports. The ports of the industrially newer and less populous South show the trade in raw materials cut off from the trade in manufactured imports. At Baltimore the exports are already double the imports, and at New Orleans the same conditions are visible in exaggerated degree. At Galveston, the newest of American ports, the ratio of exports to imports has recently changed a little from a ratio of about 100 to 1.

In exporting manufactured goods, there is the same tendency to cling to the old and great port, although the tendency is here weaker than it is in the importing of similar goods. The conservative force is the fact that manufactures usually go in small shipments of which many are required to fill a single ship. Add to this the fact that the shipper of goods of this class wishes as fast, frequent and wide-reaching sailings as possible, and it is evident that he can only get what he needs by doing business through the largest accessible port.

The United Kingdom, being a nation with import of raw materials and export of manufactures, thus reverses the commercial conditions of the United States. The table shows that her small ports reveal the same trade reversal, being importers of proportionately more goods than they export. Indeed, in several cases they export practically nothing and import considerable quantities of the raw products exported from the small ports of America.

Another way of classifying this same division of traffic is to say that the raw material port is the tramp ship port and the manufactured goods port is the line vessel port.

THE POLYNESIAN WANDERINGS

The Carnegie Institution of Washington has accepted for publication, and will promptly put to press, a very considerable volume presenting the results of inquiry into the migration of the Polynesians into the central and eastern Pacific. This is "The Polynesian Wanderings: Traces of the migration deduced from an examina-

tion of the Proto-Samoan content of Efaté and other languages of Melanesia." The author is William Churchill of New York City.

Now that this great work, by an American scholar, is to see the light under the auspices of the Carnegie Institution, it is especially interesting to note that the exploration of the ethnology and of the philology of the Pacific was in its beginning a work of American research. In Salem and in New Bedford, the return of the whalers yielded to students as rich rewards as came to the merchant adventurers in the cargo of bone and oil. This examination, by American scholarship, of the materials brought from the South Sea, culminated in the record of the scientific results of the United States Exploring Expedition under Wilkes and his corps of brilliant assistants. In this expedition Horatio Hale was the collector of the ethnographic material, and so well did he do his work that Latham characterized it as "the greatest mass of philological data ever accumulated by a single inquirer." But that was sixty years ago.

After that brilliant accomplishment, American scholars seem to have neglected the field in which preëminence had been won for their own country. The French, the English and now the Germans have been busy in the study of the languages of the Pacific, but since Hale, the Americans have seemed strangely neglectful. Now, after two generations, it may confidently be said that the leadership in the study of the philology of the Pacific has been brought back to this country.

In this volume of over 250,000 words, the author has subjected to rigid philological examination some 90 languages of Melanesia and has identified such element in them as they share with the Polynesian tongues. He has developed for each tongue its laws of phonetic mutation. The author brings further confirmation of his former discovery that the Polynesian has hitherto been wrongly classed by systematic philologists. He shows that it is properly not an agglutinative but an isolating speech. Particularly valuable is his massing of evidence to establish that here we find a language genesis, a speech in the making, all set plainly before the student in the examination of the evolution of consonant facility. Recurring to the position of John Crawfurd in 1847, but with a far greater mass of data, Mr. Churchill enters a strong plea for the dissolution of the once accepted family of Malayo-Polynesian speech.

It is possible to indicate here some of the major conclusions of the work:

Following out the line of his earlier discoveries, Mr. Churchill

notes that to Nuclear Polynesia came two swarms of Polynesian migrants at periods of time separated by centuries, the Proto-Samoan and the Tongafiti. For the later swarm he indicates no course of travel before they appear in Samoa, as the data discussed in this work do not touch upon that migration. He establishes that it was the earlier, the Proto-Samoan swarm, which swept down from Indonesia along the archipelagoes of the western Pacific.

The languages of Melanesia differ widely among themselves and differ even more widely from the Polynesian. Thus the author makes it clear that the element common to the vocabularies of Melanesia and of Polynesia is loan material borrowed by the races of inferior civilization from the more alert and intelligent brown Polynesians during their sojourn in Melanesia.

In the present meagerness of records of Melanesian speech it is impossible to ascertain quantitatively the extent of such loan material now in Melanesian possession. Lacking this element, Mr. Churchill has dissected out qualitatively the use which has been made of borrowed Polynesian material. Through this inquiry he has worked out a series of percentages of borrowing, for each of the Melanesian languages for which data are available. In this wise he has established graphic curves of isology which lead to most interesting results. Instead of being a single sweep of fleets of canoes carrying the Polynesian migration through Melanesia to its destination in the unoccupied islands of Nuclear Polynesia there were two distinct migrations of Proto-Samoans, widely separated at their exit from Indonesia, distinct in the traverse of the western Pacific, never coming together until each had established itself in Nuclear Polynesia at different spots and the period began of mingling by convection in the exchange of short voyages of love and war, and above all of adventure which took place between Fiji, Samoa and Tonga.

The association of Indonesians and Polynesians, Mr. Churchill accounts for by the same explanation of loan material. Since the languages are of different types it is impossible to conceive of their consociation in a single speech family.

He does not undertake to identify the early home of the Polynesian race west of Sumatra, for at that point the linguistic data cease to exist for philologic study.

THE MEASUREMENT OF THE INTENSITY OF GRAVITY ON THE OCEAN AND ITS SIGNIFICANCE

BY

G. W. LITTLEHALES

Considering the degree of advancement that has long since been reached in the adaptation of instrumental means to the necessities of gravitational research on the land, it was remarkable that, up to the beginning of the Twentieth century, no beginning had been made in gathering observations to reveal a knowledge of the intensity of gravity over the oceanic areas. The unsteadiness of the observing platform and the consequent effect upon the inertia of masses, even under exceptional circumstances of calm at sea, are such as to preclude the application of methods depending upon the measurement of the time of flight of a plummet, or the oscillation of a pendulum, or, in any direct way, the changing relation, with change of locality, between a given mass and its weight.

Nearly thirty years ago attempts were made to determine the variation of the intensity of gravity, from place to place, by employing a syphon barometer whose short arm was closed, and contained a certain quantity of gas. At a given temperature this gas had a certain volume and exerted a certain pressure to contribute toward balancing the mercurial column; the greater the intensity of gravity, the greater would be the relative heaviness of the mercury and the shorter would be the barometric height corresponding to the pressure. The required exactness could not be attained either on the land or on the sea by this method because of the insuperable difficulties that arose in ascertaining proper corrections for temperature; and it was not until Dr. O. Hecker, using the method suggested by Mohn of Christiania, made elaborate experimental measurements,* under the auspices of the International Geodetic Bureau, on board the steamer Petropolis, of the Hamburg-South American Line, between Europe and Brazil, in the summer of 1901, that the first actual measures of the intensity of gravity over an oceanic basin were determined.

* "Bestimmung der Schwerkraft auf dem Atlantischen Ozean sowie in Rio de Janeiro, Lissabon, und Madrid," von O. Hecker, Königl. Preussischen Geodatischen Institutes, neue folge, No. 11, Verlag von P. Stankiewicz, Berlin, 1903.

The operation consisted of employing, side by side, a boiling-point apparatus and a mercurial barometer, and comparing the true pressure of the atmosphere as indicated by the temperature of unconfined steam with the pressure indicated by the height of the barometric column.

In the mercurial barometer a mass of mercury is made to mount to a certain height in balancing the pressure of the atmosphere; and this height is greater or less, for the same absolute pressure of the atmosphere, according to the weight of the mass of mercury in the barometric column. And since the weight of a given mass of matter is dependent upon gravity, a definite relation must exist, at any given place, between the height of the mercurial barometer and the boiling-point of water. This relation is altered on going to another place where the intensity of gravity is different, and hence the comparison of the readings of the mercurial barometer and the boiling-point thermometer affords the means of determining the variation of the intensity of gravity from place to place.

The practical applicability of the method depends upon the exactness with which the instrumental readings can be observed on board a ship at sea. With a good barometer, the barometric reading can be obtained to within an amount ranging from one-fiftieth to one-twentieth of a millimeter. To obtain with the hysometer an exactness corresponding to that with which the barometer can be read, the thermometer should give the boiling-point temperature to within such a fraction of a degree as corresponds to a few hundredths of a millimeter on the mercury column. At a barometric height of 760 millimeters, one-tenth of a millimeter corresponds to 0.0037 of a degree of temperature, or one one-hundredth of a millimeter to 0.00037 of a degree; and at a barometric height of 650 millimeters, one-tenth of a millimeter corresponds to 0.005 of a degree of temperature and one one-hundredth of a millimeter to 0.0005 of a degree. Hence to obtain the true atmospheric pressure to within one-twentieth of a millimeter, the boiling-point thermometer should give the temperature to within 0.002 of a degree.

In spite of the refinements demanded and of the necessity for eliminating the effects of the movements of the observing platform upon the barometric column, memorable results* have been attained in voyages traversing the Pacific and Indian oceans as well as the Atlantic, which exercise a broad influence in geography.

* "Bestimmung der Schwerkraft auf dem Indischen und Grossen Ozean und an deren Küsten," von O. Hecker, Zentralbureau der Internationalen Erdmessung, neue folge No. 16, Georg Reimer, Berlin, 1908.

Before this achievement, knowledge in relation to the intensity of gravity and its variations on the globe was confined to the land masses; and geodesists, taking together the available measurements of the intensity of the gravity resulting from pendulum experiments in various parts of the world and the observed deflections of the vertical disclosed by the comparison of geodetic triangulation with astronomical observations, had deduced a theoretical expression for the normal value of gravity at sea level according to which its intensity was represented as increasing from the equator to the poles by increments proportional to the square of the sine of the latitude and the square of the sine of twice the latitude jointly. Standard gravity was defined as the intensity of gravity in latitude 45° at sea level, and meteorologists had adopted the custom of reducing barometer readings made both on the land and on the ocean to standard gravity as computed from this theoretical expression. It was therefore a matter of import to meteorology that it should be ascertained, by observation and measurement, whether the theoretical variation of the intensity of gravity with latitude actually applied to the oceanic as well as to the continental areas. The general results of the relative determinations that have been made at sea is to establish the fact that gravity is normal over the surface of the ocean. Locally, as in the vicinity of the Tonga Islands, there are irregularities; and there is a highly interesting variation in intensity in passing outward from a continent to the deep sea, according to which the intensity is in excess in the shallow coastal waters, in defect at the beginning of the deep sea, and thence of normal value.

Moreover, studies of pendulum and geodetic observations had also given rise, during the last century, to theories respecting the distribution of matter inside of the earth, and these could not be confirmed or extended until the intensity of gravity over the oceanic areas was made known. Exact triangulation and surveying had revealed a relation between the deflections of the plumb line and the plateaus, mountains, and valleys constituting the visible irregularities of the earth's surface; but computations had shown that the deflections of the vertical which must be produced by the attraction of these visible irregularities of the earth's surface are much greater than those which are observed, and that beneath the crust of the earth there must be such a distribution of the densities of materials as will bring about an incomplete balancing of the effects of the visible topography upon the direction of the plumb line. The recog-

nition of this relation between the sub-surface densities and the surface irregularities of the earth was the foundation of the doctrine of isostacy, which postulates that above a certain depth, at which the pressures in the interior of the earth are equal in all directions as in a perfect fluid, there will be in every vertical-sided, inverted, truncated pyramid, of equal cross section, reaching to the surface of the earth, the same amount of matter. Thus, if it be true, as geodesists have computed,* that the depth of compensation is 114 kilometers below the sea level, any column extending down to this depth below sea level, and having one square kilometer for its base, has the same mass as any other such column. One such column, located under a mountainous region, may be 3 kilometers longer than another located under the sea coast. On the other hand, the solid portion of such a column under one of the deep parts of the ocean may be 5 kilometers shorter than the column at the coast. Yet, according to the doctrine of isostacy, each of these three columns will contain the same quantity of matter. The masses being equal and the lengths of the columns different, it follows that the mean density of the column beneath the mountainous region is 3 parts in 114 less than the mean density of the column under the sea coast. So, also, if the intensity of gravity is normal over the surface of the ocean, the mean density of the solid portion of the sub-oceanic column would have to be in excess of the mean density of the seacoast column by an amount somewhat less than 5 parts in 114, seeing that the water of the ocean virtually constitutes a part of the column.

Inasmuch as actual measurements have shown that the intensity of gravity is normal over the Atlantic, Pacific, and Indian oceans, the theory of isostacy is validated, for not only must the superficial masses of continents be compensated by a defect of density in the earth's crust beneath them, but the lightness of the ocean must also be compensated by an excess of density under the ocean bed.

To be able to say that, through a thickness of 70 miles, the mean density of the earth's crust is 7 per cent. greater under the floor of the ocean than under the continents is to limit the range of controversial subjects connected with terrestrial physics.

Concerning the dispute as to whether the oceans have always had

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* "The Figure of the Earth and Isostacy from Measurements in the United States," by John F. Hayford, Inspector of Geodetic Work, and Chief, Computing Division, Coast and Geodetic Survey. Department of Commerce and Labor, Coast and Geodetic Survey, Washington, Government Printing Office, 1909.

the same general extent and positions since the waters were gathered together or as to whether, by alternate rising and sinking of the earth's crust, oceans and continents have successively occupied the same areas, the deciding stroke appears to have been delivered in favor of the permanence of ocean basins, on account of the extreme improbability that there could be such a shifting of materials in the depths of the earth's crust as would cause the sub-oceanic heaviness to give place to the sub-continental lightness which has been found to subsist.

Henceforth, more definiteness of thought may, therefore, characterize the treatment of the train of geographical questions which depend upon the delimitation and the circulation of the oceans, and their effect upon evolutionary processes.

A NEW MAP OF ARABIA

A map of Arabia on a scale of 32 miles to an inch is at present under publication in India. The compilation, from all available sources of information, is by Captain F. Fraser Hunter, Indian Army, of the Survey of India, and is the result of some years of diligent research.

The projection is the same as that adopted by the Survey of India for the 32-mile-to-the-inch map of India—*i. e.*, the modified secant-conical, a feature of which is that there is no central meridian. This projection enables the map of Arabia to be fitted alongside the map of India, thus giving, at a glance, a map of that portion of the world between Burma and Egypt. It should be possible, later, to produce other such maps to include China and Africa.

Captain Hunter's map of Arabia is the first and only one compiled on so large a scale, and it should shed much light on hitherto obscure points in the geography of that region and be a stimulus to more exact inquiry in the future.

The main points of interest in this new map are: Charles Huber's notes have been recompiled and all his astronomical observations worked out and corrected. His barometric readings have been reduced to their correct value by comparison with sea-level readings, taken, at the same instants, at the Survey of India tidal stations at Bombay, Bushehr and Aden (Loomis's Formula).

The map sheds much light on the various routes, pilgrim and otherwise, across Arabia, gives a new and definite theory as to the great Tuwaiq Range and the Wadi Dawasir system, assigns a new position to the much-disputed Jabrin oasis, and leaves little to be conjectured as to the whole Persian Gulf littoral and much of its hinterland. The topography of the Oman peninsula has been more definitely depicted, conflicting authorities as to the geography of the Hadhramaut have been reconciled, and much new data on that region utilized. Of the southwest corner of Arabia, from the large geographical point of view, it leaves nothing now to be ascertained. At the same time, all former and new information as to Yaman has been added to the work of Herr Glaser. The Hijaz Railway is shown completely.

These are a few of the many points entered into by this new map. But the chief lesson it brings home to geographers is that, by the very largeness of its scale as compared with other maps, it shows what an immense stretch of the unknown still lies in Arabia.

The system of transliteration is that recently adopted by the Government of India.

It is understood that an effort is to be made to include in this map, before final publication, the routes of Captains Butler and Aylmer and of Mr. Douglas Carruthers. The data from these two expeditions were not available when this map was completed.

GEOGRAPHICAL RECORD

NORTH AMERICA

Carl Lumholtz's Explorations. The Society has received a letter from Mr. Lumholtz, written at Sonoyta, in the Northwest part of Sonora, Mexico. on April 4. He left New York in May, last year, to make ethnological and physico-geographical investigations in the arid northwestern part of Sonora (*Bull.* 1909, p. 383). He writes that he has been at work there for many months and has also included in his field the adjacent southwestern part of Arizona. Sonoyta is an oasis in the arid region and he had just returned there from a three months' journey in the desert proper, travelling west to the Colorado river, south to the Gulf of California and north to the southern Sierras of Arizona. The region is very little known. Drs. Hornaday and Macdougal, in their journey, about two years ago, went only a short distance to the west and south of the Pinacate Mountains.

Mr. Lumholtz travelled entirely around the Pinacate region which extends about 50 miles, north and south. He also spent several days at Sierra Blanca,

south of it, a hitherto unexplored mountain range. In the arboreal desert west of Pinacate, there are comparatively few Sierras or Cerros but he visited several that were unexplored and nameless. One mountain, which he named El Capitan, southwest of Sierra de la Tinaja Alta, will be a landmark for travellers who must pass it to reach Laguna Prieta, an interesting lake on the border of great sand dunes. Its waters are salt but potable water is found by digging among the bullrushes on its marshy shore. When he reached the lake his animals had been 76 hours without water.

From the Colorado river he travelled south along the coast, using water, more or less brackish, for 20 days. A spade is needed in the outfit to dig for water at some places known to the Indians and a few Mexicans. At one place drinkable water was found on the beach, covered at high tide but oozing between some rocks at low tide. Grass for the animals was not abundant, but there are several kinds, the most important being the *galleta.* A number of bushes, especially the *chamiso,* supply good fodder; but the leaves of the ironwood tree are best relished by horses, mules and donkeys. As a rule, his animals had water only once in 36 hours. Sometimes they were 72 hours without it. The mules and donkeys stood this well when the weather was not very warm, but most of the horses died in the sand dunes though born in these western regions. Donkeys are best adapted for this kind of exploration, and mules next.

While at a water hole in the Pinacate region, Mr. Lumholtz, with two Indians, made a 13-days' trip to explore a Sierra which is visible both from Pinacate and the Colorado river. They found only two water places, so-called tinajas (natural tanks), where rain water collects. They travelled 175 miles and returned to camp with their burros (donkeys) in good condition. One of them carried two barrels of water, about 200 pounds. Mr. Lumholtz continues:

"The tinajas are drying up for there has been no rain this winter, excepting a little in January, in the extreme western part of the desert. Still the vegetation, such as it is, seems to thrive. The curious, straggling *ocotillos* show their splendid red flowers that look so well against the gray and somber background of the Sierras. In the sand beds of the arroyas, dry since last September, grow *chuparosa* higher than a man, covered with hundreds of flowers. The brittle bush near it is covered with yellow flowers and both suggest tropical luxuriance. These plants must have their roots very deep in the sand.

"The desert is usually silent, to be sure, but has its animal life. Quails are found up to 20 miles from water; also the mocking bird and several other songsters. Hawks and buzzards are found everywhere. Lizzards, mice and rats abound. The mountain sheep is numerous among all the Sierras from the Colorado and Gila rivers almost as far as Hermosillo, the Capital of Sonora. Jack rabbits and cotton tails are seen but are not numerous. These animals, apparently do not need much water. The Indians say that the animals of the desert never drink, unless it rains. The antelope is fond of eating the spring *cholla,* which contains a great deal of water; hence its abstinence from water may be understood. Mexican cattle are known to subsist for weeks and months on the green and juicy herbs of the sand dunes, after the winter rains, as well as on the *cholla,* without needing to drink water, and they grow fat by it. This, I might verify by many interesting facts.

"The country explored by me is a great arboreal desert, with numerous Sierras, much worn down. They run almost invariably from southeast to north-

west and, oddly enough, this is generally also the direction of the veins of ore here. The formation is granite and volcanic.

"Across this arboreal desert, in its southern part, runs a belt of sand dunes, from Puerto de Lobos, in the neighborhood of Caborca, almost to the Colorado river. It is generally close to the sea, but gradually retires somewhat from the coast. At Laguna Prieta, it is nearly 20 miles away. This belt of sand dunes is interrupted for some miles at Sierra Pinto. The largest sand dunes are found in the western part of the belt. I measured one by my aneroid and found it to be 185 feet high; others may be slightly higher. The sand dunes are of a somewhat reddish hue and there is nothing depressing about them.

"I shall have a later opportunity to describe their peculiar animal and plant life. As for those interesting natives of the desert, the Papago Indians, I shall also have to defer to the near future, any mention of them."

IMPOVERISHING THE SOIL. The great grain regions of Central Canada are producing larger crops of wheat every year, but this is because the acreage sown to wheat is rapidly increasing and not for the reason that anything is yet being done to maintain the fertility of the soil. The statistics in "Canada West," one of the recent publications of the Department of the Interior, Canada, show that the average yield, per acre, in Manitoba was 26 bushels in 1902, 14.22 bushels in 1907, and 17.28 in 1908; Saskatchewan, 25.41 bushels in 1901, 14.9 in 1907 and 13.60 in 1908; Alberta, 24.58 bushels in 1901, 22.13 in 1907 and 22.60 in 1908. In fact, the pioneer farmers of that great, new source of wheat supply are following the same system of incessant cropping of the land that has reduced the average production in our own great wheat states to 13.5 bushels per acre while in England it is 30 bushels, in Belgium, 34.5 bushels and in Germany, 27 bushels. The needs of the world, of course, will ultimately require that these exceptionally fine wheat lands be won back to their early fertility by scientific tillage.

SURVEY OF THE NORTHERN AND NORTHWESTERN LAKES. The U. S. Lakes Survey Office, Detroit, Mich., has issued *Bulletin* 19, giving a description of the Great Lakes, their harbors, channels, and navigable tributaries, with a large amount of detail of special use to mariners. This publication is issued annually, No. 19 being current during the present year, while supplements are issued monthly during the navigable season to supply all items of change affecting the published matter of the Bulletins. Thus the Bulletins and Supplements together supply the detailed descriptions and the particulars of constantly changing conditions that cannot be shown on the charts. These publications are supplied free of charge to navigators and other chart purchasers.

SOUTH AMERICA

IRON RESOURCES OF BRAZIL. The Geological Survey of Brazil has prepared a report on the available iron-ore supply of the country for the International Geological Congress which meets at Stockholm this year. Attention is called to the enormous wealth of the State in this respect. It is stated that when the full text of the report is published it will startle the iron world and be the sensation of the congress. On the basis of the examination of fifty-two localities in Minas Geraes it is reported that the ore is from 60 to 75 per cent. pure iron and free from all impurities that would interfere with its proper smelting. The total amount of easily accessible high-grade ore in the state of Minas Geraes alone is

conservatively estimated at 12,000,000,000 tons. In addition, high-grade ores are found in seven other states and iron ores of good appearance are known in every state in the country. The ores of Minas Geraes, São Paulo, Bahia, and Matto Grosso are predominatingly hematites, the others chiefly magnetites. The ores of Minas Geraes occur in one of the oldest and most densely populated interior regions of the country and on the road to the diamond mines of the northern part of the state, though about 500 kilometers from the coast. It is proposed to carry a railway line from the ore fields to the excellent port of Victoria and so improve the facilities for handling the ore that this port will become the center of the export industry. The iron ores occur in beds of quartzite and clay slates with subordinate beds of limestone, the whole series resting upon a complex of crystalline schists and gneisses intruded with granite. The massive portions of the iron-ore beds stand out as conspicuous topographic features, because of superior hardness, in the form of ridges heavily cloaked with ore rubble. Without coal deposits of comparable extent, Brazil can not hope to become a leader in the iron world unless other sources of power be developed or new sources discovered. The relative nearness of the deposits to the sea and the low rate of ocean transportation may offset this disadvantage however and make it possible for Brazil to supply the industrial countries of the northern hemisphere with cheap iron-ore when their deposits have become extensively depleted. ISAIAH BOWMAN.

PROF. BREWSTER'S LECTURE. On Feb. 15, Professor James H. Brewster, of the University of Michigan, gave a lecture before the Society on certain phases of life in South America under the title "From Bahia to Buenos Aires." Mr. Brewster emphasized the remarkable diversity of conditions in the southern continent, gave a summary of the causes of this diversity, and showed that what is first needed for a correct understanding of our southern neighbors is to avoid forming too general a conception concerning them.

The superior illustrations, 100 in number, which accompanied the lecture, well exemplified this diversity. Views of São Salvador da Bahia, the old colonial capital of Brazil, were contrasted with a few scenes from the old Inca capital, Cuzco, in the same latitude. The characteristic features of Rio de Janeiro, Petropolis, and São Paulo were illustrated, as well as those of Montevideo, Buenos Aires and its neighbor, La Plata.

ASIA

THE STUDY OF TROPICAL FORESTS. Prof. J. Paul Goode writes to the *Bulletin* from Chicago that a private letter from Manila, announces the publication of Dr. H. N. Whitford's work on "The Composition and Volume of the Dipterocarp Forests of the Philippine Islands." It is issued by the Forestry Bureau of the Philippine Islands and represents several years of field work by its author. The magnitude and financial value of these forests are strikingly shown by a single quotation: "Our virgin forest area comprises 25,000,000 acres and has 200 billion board feet of timber standing on it. This is a good showing when compared with the 400 billion feet of timber on the 200,000,000 acres of the United States Forest Reserves."

Dr. Whitford is now at work on a larger and more complete monograph on "The Forests and Principal Forest Trees of the Philippines." The success of

the work done by our forestry service in the Philippines has won the admiration of all the governments interested in tropical forests. Dr. Treub, former director of the Botanical Gardens of Java, has sent a man to Manila to study the American forestry methods. An official of Portuguese East Africa has written asking Major Ahern, Director of Forestry, if he can send two experts to organize a similar survey for the African forests. Mayor Ahern in reply, gives some facts that will be of interest to Americans in general:

"The Bureau of Forestry has had the difficult task of investigating, protecting, and developing the enormous forest areas of the islands, without adequate men and funds for carrying on the work. In spite of these difficulties, however, most of the forests have been classified, estimated and mapped, and we now know what the forests of the Philippines contain, where and how the different forest types are situated, and the approximate cost of placing their lumber on the market.

"The forest wealth of the Philippines is found most largely, not in the high-priced cabinet woods, although their value is very large, but chiefly in the stands of cheaper structural timbers, such as may be used for most purposes in place of Oregon pine and Baltic fir and other similar timbers in Europe and America. This is distinctly advantageous, although it is contrary to the general idea of the composition of tropical forests. The value of the timber is further increased by the fact that the structural species often occur in almost pure stands and in large quantities, making their logging by modern steam methods comparatively simple and economical.

"I believe that the structural possibilities of tropical forests have been decidedly underrated, and that an investigation of other countries besides the Philippines will show large bodies of timber that can be lumbered cheaply and used for general construction purposes, for which there is always a large and steady demand."

Major Ahern adds: "Of all the men who, under my direction, have had charge of the forest work in the Philippines, chief credit is due to two foresters for what has been accomplished. These are Dr. H. N. Whitford, Chief of the Division of Investigation in this Bureau, and Mr. H. M. Curran, Forester in the same division."

These two men have an ambition to explore and take an inventory of tropical forests in general, the world around, and are hoping to obtain financial aid from the various countries interested, and possibly from private sources, and to organize extensively for the work.

Dr. Whitford is convinced that the "value of the tropical forests as a world asset is not appreciated, simply because our knowledge concerning their possibilities is so limited." He believes it is possible to open up to the world's commerce, immense wealth in tropical timber.

AUSTRALASIA

Surveys in Western Australia. The Report of Surveyor General Johnston, for the year ending June 30, 1909, shows that the Department of Lands and Surveys is making diligent study of the economic resources of the State other than mineral wealth, which, in earlier years, has absorbed the largest share of attention. Several parties, in the past fiscal year, have been engaged in the

coastal country between Manjimup and Denmark, determining the extent of valuable forests and of lands with little marketable timber that are worth throwing open to settlement. It appears to be the policy to keep the best timbered lands out of the market in order to conserve the supply. Some of the survey parties report important areas that are suitable for cultivation and also great stretches of plains with sandy subsoil that, in places, are covered with a sufficient depth of mould to justify the belief that they may be turned into useful grass lands. The year's work resulted in a large number of maps and plans.

POLAR

PEARY'S SOUNDINGS FROM CAPE COLUMBIA TO THE POLE. On March 22 last, the Hon. J. Hampton Moore, of Pennsylvania, spoke in the House of Representatives, Washington, on Commander Peary's discovery of the North Pole. He gave considerable hitherto unpublished information, the most important relating to the soundings that were taken on the ice journey between Cape Columbia and the Pole. The following data are from Mr. Moore's speech which was printed in full at the government printing office. Here is the table of soundings:

SOUNDING BY	LATITUDE.	FATHOMS.	REMARKS.
	83° 7′	0	
Marvin	83° 10′	98	Edge of glacial fringe.
Marvin and McMillan	83° 25′	96	
Bartlett	83° 53′	110	Edge of continental shelf.
Marvin	84° 29′	825	
"	84° 39′	580	
"	85° 23′	310	
"	85° 33′	700	No bottom.
Bartlett	87° 15′	1,260	" "
Peary	89° 55′	1,500	" "

In Commander Peary's notes he says that the sounding equipment consisted of two reels of specially made piano wire of 1,000 fathoms each, and three 20-pound leads with clam shell device for grasping samples of the bottom. One of the reels and leads was carried by Bartlett with his advance party and the main party carried the other reel and two leads. Portions of the main party's wire and the two leads were lost at various times, in hauling up, probably on account of kinks in the wire. When the main party sounding of 700 fathoms, no bottom, was made, this was all the wire they had left. When Bartlett ran out 1,260 fathoms, he stopped on account of a kink in the wire which he feared would part when the wire was hauled up. At this time, his 1,000 fathoms of wire and the remaining 500 fathoms of the other reel had been combined. Peary took this combined wire and made his sounding with it near the Pole, 1,500 fathoms, no bottom, and was hauling up when the wire parted again and he lost nearly all of it and the last lead. These facts explain the irregularity of the soundings that did not get bottom. Commander Peary adds these comments:

"The sounding of 310 fathoms at 85° 23′ naturally impressed me at once as surprising and when Marvin reported the result to me, immediately after taking the sounding, I at once asked him if he was sure that he had the bottom, and he replied that he was, as the fact of this pronounced shoaling from 825 fathoms to 310 impressed him at once, and he made sure that his depth was correct.

"Again, when the sounding of 700 fathoms and no bottom was made about

10 miles further north, we both spoke of the peculiar fact of this outlying ridge with deeper channel intervening between it and the continental shelf, and Marvin again said that he was sure of his 310 fathoms reading.

"Had it not been for the loss of the last lead and practically all of the wire while making the soundings at the Pole, I should, on the return, have interpolated other soundings.

"The profile indicates that a line of 5-mile interval soundings from Cape Columbia to the eighty-sixth parallel might develop a particularly interesting profile of the bottom of the Arctic Ocean."

Mr. R. A. Harris, the tidal expert of the Coast and Geodetic Survey, reported on Peary's tidal records which consisted of practically unbroken series of hourly readings of the height of the tide, taken night and day, at Cape Sheridan for 231 days, Cape Columbia, 29 days, Cape Bryant, 28 days, and Fort Conger, 10 days. Mr. Harris says that, in order to show the full geographical value of the results, they must be considered in connection with all other Arctic tidal results. This work is now in progress. Peary's tidal observations leave little to be desired between Cape Morris Jesup and Cape Columbia; but there are long stretches of the Arctic coast where nothing is available. This is especially true of the Russian coast and the western and northern portions of the Arctic archipelago. Peary's results show that the tides along the northern coasts of Grantland and Greenland differ in many respects from what had been supposed. For example, his records prove that the tide occurs three hours earlier at Cape Columbia than at Cape Sheridan, and not later, as had been assumed.

PHYSICAL GEOGRAPHY

LANDSLIDES. In a recent study of landslides (Landslides in the San Juan Mountains, Colorado, by Ernest Howe, *Prof. Paper* 67, U. S. Geol. Surv., 1909, pp. 1-55), Mr. Howe describes the Cimarron landslide of 1886 and two other recent landslides. The older groups of landslides of the Telluride, Rico, Silverton, and three other districts are presented, together with one slip which seems to be interglacial. The classification and explanations of landslides by Heim and by Penck are summarized. The landslides of the San Juan Mountains are then discussed in relation to shattering, jointing, relation of weak and resistent layers and other physical conditions which vary considerably in the sedimentary and the volcanic rocks of the landslide areas. These factors have had a stronger influence on landslides than structural conditions. Topographic conditions, especially the oversteepening of valley walls through glacial erosion, have had an important relation to the landslides, as have certain external causes, such as earthquakes, readjustment of internal stresses in the mountains, and saturation of the rocks by meteoric waters. A classification of the hundred or more San Juan landslides is presented.

A specialized type of landslides, the rock streams, are discussed by Howe, Patton, and Capps. The first descriptions are in the above publication (pp. 31-41, 49-55), where Mr. Howe describes a number of these forms. They seem to be intermediate between ordinary talus and landslides and look like small glaciers completely covered with ablation moraine. One of these streams is three-fourths of a mile long, one-fourth of a mile wide and 50 to 100 feet deep. An adjacent mud flow is over six miles long. The streams are illustrated by

excellent photographs and maps. They are classified as due to rock falls, in contrast to rock slides which result in landslides. In the case of the rock streams it is conceived that the rocks are shattered, and if the mass is of sufficient magnitude, the shattered rock may move outward from the base of the cliffs with great velocity as a flow of newly-made detritus.

Prof. H. B. Patton describes a second group of rock streams, also from Colorado (Winter meeting, Geol. Society of America, Dec., 1909). They are on the west side of Veta Mountain, east of the Sangre de Christo Range.

The third series of rock streams are in Alaska (Rock Glaciers in Alaska, by Stephen R. Capps, Geol. Soc. of Washington, *Science,* N. S., Vol. XXX, 1909, page 974). Mr. Capps describes a series of rock streams, also shown finely on the Nizina Special map of the U. S. Geological Survey. They are from one-half mile to two and one-half miles long, from one-tenth to three-fifths of a mile wide and have slopes varying from 9° to 18°. "In slopes, shape, and surface markings they bear a striking resemblance to glaciers. In the upper portions, longitudinal ridges and furrows are conspicuous, while toward the lower ends the ridges become concentric, parallel with the borders of the lower ends of the flows. A few of the rock glaciers actually grade into true glaciers at their upper ends." All these rock glaciers are said by Mr. Capps to be cemented with interstitial ice which has imparted their motion to them. Why they are not dying glaciers is not stated.

These Alaskan rock streams or rock glaciers head in cirques which no longer have perennial snows, although adjacent higher cirques produce many glaciers in the same region. This raises the question whether the Colorado rock streams, described by Messrs. Howe and Patton, some of which, at least, head in cirques and which except for the observed interstitial ice seem exactly like the Alaskan masses, may not have been formed in association with the former glaciers of Colorado.

LAWRENCE MARTIN.

A NATIONAL BUREAU OF SEISMOLOGY. The following resolution was passed by the Seismological Society of America at a meeting held in San Francisco, on March 2:

"Resolved, that the Seismological Society of America strongly favors the establishment of a National Bureau of Seismology with power: (*a*) To collect seismological data; (*b*) to establish observing stations; (*c*) to study and investigate special earthquake regions within the national domain; (*d*) to co-operate with other scientific bodies and organizations and individual scientists in forwarding the development and disseminaton of seismological knowledge.

"It also favors the organization of this bureau under the Smithsonian Institution with the active co-operation of other scientific departments of the government."

Copies of the resolution were sent to the President, President of the Senate, the Speaker of the House of Representatives, Secretary of the Smithsonian Institution and the members of the House Committee on Library which has this matter under consideration.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

Die Polarforschung, ihre Ziele und Ergebnisse. Von Eugen Oberhummer. 53 pp. Vorträge des Ver. zur Verbreitung naturwissens. Kenntnisse in Wien, Vol. 48, Heft 17, Wien, 1908.

A lecture by the Professor of Geography in the University of Vienna, giving a summary of polar endeavor, its purposes and results. Dr. Oberhummer, writing before the attainment of the North Pole, said he had no doubt that this event was approaching; and when the Pole was reached, the value of the achievement would not appear very important and systematic and scientific exploration would again take the foreground.

The United States, with Excursions to Mexico, Cuba, Porto Rico and Alaska. Handbook for Travellers by Karl Baedeker. Fourth Revised Edition. cii and 724 pp., 33 Maps, 48 Plans and Index. Karl Baedeker, Leipzig; Charles Scribner's Sons, New York, 1909. M. 15.

It was a peculiarly difficult task to write a first rate guide book of a country so vast and so rapidly changing as the United States. From the first, however, Baedeker's United States was a great success and the succeeding editions have kept it up to date. The effort to make this book comparable with those in the same series on the countries of Europe was an arduous task and the publisher is to be congratulated on the success attained. The work appeals not only to the foreign but also to the American traveller and in the present edition more emphasis is given, than in the earlier issues, to many places that are interesting from their association with American history and literature. Praises for Baedeker are much like commendation of the alphabet but it may, at least, be said that we have no publication in our country that fills the place of this Handbook; and we shall be glad if, in a generation or two, we may be able to fill any American book in the general trade, with such superior and efficient maps as are to be found in this volume.

Geographisches Handbuch. Allgemeine Erdkunde, Länderkunde und Wirtschaftsgeographie. Unter Mitarbeit hervorragender Fachmänner, herausgegeben von Albert Scobel. Fünfte neubearbeitete und vermehrte Auflage. In zwei Bänden. Erster Band—Allgemeine Erdkunde, Länder-und Staatenkunde von Europa. xvi and 957 pp., 522 Illustrations and maps in

the text, 7 black and 5 colored plates and a colored map; Zweiter Band—Länder and Staatenkunde der aussereuropäischen Gebiete. Wirtschaftsgeographie. xiv and 816 pp., 204 Illustrations and Maps in text, 7 black and 7 colored Plates, Bibliography and Index. Velhagen & Klasing, Leipzig, 1909. M. 20.

Every issue of this standard Handbook has been awaited with interest, because, on the whole, it is the best work of the sort that is published. The five editions form, in themselves, a good summary of geography. The present issue is the first in two volumes and contains fully three times as much matter as any of the earlier editions. The editor had the collaboration of fifteen of the leading geographers of Germany, all men of international reputation, as Penck, Krümmel, Drude Meinardus, Rein and Sapper. This work, appearing every few years, with its hundreds of maps and diagrams and its authoritative letterpress, keeps nearly every phase of geography up to date, dealing not only with the descriptive side of the study but also with most other geographical aspects. It is perhaps noteworthy, and a little curious, that Prof. Scobel, the able editor of all the issues of this work and the Director of the map house of Velhagen & Klasing, does not provide an occasional article on cartography.

The work especially appeals to teachers, students, merchants and intelligent persons, who read German, as a guide and reference book in geography.

Miguel Triana. Por el sur de Colombia. Excursión pintoresca y científica al Putumayo. Prológo de S. Pérez Triana. xxiii and 355 pp., Map and Index. Garnier Hermanos, Paris (1908).

The author is a Colombian civil engineer, who went inland from Tumaco, one of the Pacific ports of Colombia, to search for routes that might be made practicable wagon roads between the highlands of the Andes, at Pastro, and navigable tributaries of the Amazon. A little steamer took him as far inland as Barbacoas on the Telembi R. His journey thence was along the wretched path which laden mules have travelled, for generations, to Pasto. His real work began at this point, whence a short journey to the southeast took him to La Cocha, a large lake, 9,000 feet above the sea, from which issues the Guaimés branch of the Putumayo tributary of the Amazon.

He descended this branch, to its junction with the Putumayo, making the journey in a canoe, in spite of rapids and other obstructions. The Putumayo itself is very well known, for the present President of Colombia descended it in 1874, about 1,000 miles, to its mouth; and Dr. Crevaux in 1878-9, ascended the river for 800 miles to Cuemby, in a steamer, and reported it navigable to that point for vessels drawing 6 feet. It is believed to be better adapted for navigation than most of the Amazon tributaries.

Having reached this known river, the explorer turned north and ascended the Guineo affluent of the Putumayo and then crossing a divide, paddled up the Mocoa affluent of the Caquetá or Yapura, another of the great Amazon tributaries. He thus examined three water approaches to great rivers leading to the Amazon. He seems to have proven that it will be a difficult and very expensive undertaking to connect this part of the Andean plateau with good navigation leading to the Amazon. His book is delightful reading, for it is not merely a scientific record but graphically describes a very little known part of southern Colombia.

Henry Hudson. A brief Statement of his Aims and his Achievements. By Thomas A. Janvier. To which is added a Newly-Discovered partial Record now first Published, of the Trial of the Mutineers by whom He and Others were Abandoned to their Death. 148 pp. and Illustrations. Harper & Brothers. New York, 1909. 75c.

This careful little volume is of the nature of a brief description of what Hudson accomplished and of the ambitions that shaped his life work. Concerning the statement that Verrazano, the Italian sailor and Gomez, the Portuguese mariner, saw the Hudson river nearly a century before Hudson discovered it, Mr. Janvier says that it is impossible to decide whether Gomez did or did not pass through the Narrows and enter the Upper Bay. "In regard to Verrazano—admitting his report to be genuine—the fact that he did pass through the Narrows into the Upper Bay is not open to dispute. He therefore must have seen—as, a little later, Gomez may have seen—the true mouth of Hudson's river, eighty-five years before Hudson, by actual exploration of it, made himself its discoverer. But Verrazano, by his own showing, came but a little way into the Upper Bay—which he called a lake—and he made no exploration of a practical sort of the harbor that he had found."

The new manuscript records of the trial of the mutineers give the sworn testimony of six eye-witnesses as to the circumstances of the abandonment of Hudson in Hudson Bay.

Mountaineering in the Land of the Midnight Sun. By Mrs. Aubrey Le Blond, President of the Lyceum Alpine Club. 71 illustrations and a map. xii and 304 pp. J. B. Lippincott Company, Philadelphia, 1908. 8vo. $3.50.

This is an extremely pleasant and entertaining book on mountain-climbing, well written, well illustrated from good photographs, and brimming with an enthusiasm that inspires the reader to follow in Mrs. Le Blond's footsteps. She has had great experience in the climbing field, at first in the Alps, but when a son of her constant guide was killed on a climb, the incident terminated her Alpine ascents and caused a search for some other desirable locality which she found in far northern Lapland. Here was discovered "all the charm of the unknown," with a summer day, 24 hours light, in which to assault a splendid series of snowy peaks. Add to this the picturesque Lapps, the innumerable lakes, the reindeer, and many other interesting features, and the picture becomes even more fascinating to the explorer. The many mountains, as yet unscaled, were all 200 miles north of the Arctic Circle and, of course, the natives declared the summits unattainable, yet Mrs. Le Blond and her guide, Joseph Imboden, who had been with her for 15 seasons in the Alps, and his remaining son, Emil, achieved many triumphs during the five summers in succession which they devoted to the conquest of this region. They made 26 first ascents. Mrs. Le Blond had no narrow escapes for, to the expert mountaineer, these happenings indicate carelessness or inexperience, and the taking of useless risks, and are, therefore, not considered at all gloryfying. The field was new; they found no paths broken by previous climbers, but marked out routes of their own. "Odd as it may seem," she remarks, "the least important duty of a guide is to know the way, while one of his first duties is to find it." "On a really hard mountain the way varies from day to day—nay even in ascending and descending." Although they were so far north,

the thermometer was often up to 85° F. in the shade, but this was no great hindrance. Indeed, few discomforts could much reduce the enjoyment of one so thoroughly appreciative of the great beauty and grandeur of the scenes amid which she toiled, and so capable of perceiving the reality of things—never mistaking petty, unpleasant trifles of the moment, for monstrous misfortunes.

"Such a view as I saw from the Kjostind my eyes had never rested on before: it alone was worth a longer journey than I had made from England." This sentence is quite typical of the whole book, the tone throughout being one of complete enjoyment. Mrs. Le Blond scorns even to try to make "record ascents" but marches to great heights for the mere love of it; and everywhere and all the time, high up or low down, she perceives a world of beauty and delight which her pen deftly and happily presents. Her senses are keen, her estimates temperate, her judgment well-balanced; in fact this book is simple, frank, sensible and instructive.

Two of the greatest dangers of Alpine climbing are absent in Lapland—the cold and the darkness—and consequently Mrs. Le Blond describes the region as the playground for guileless climbers. There is a clear, brief description of the origin and flow of glaciers, of a thunderstorm (rare above the Arctic Circle) of a practical tent for photographic purposes, and useful remarks about photographic exposures under the feeble rays of the midnight sun, as well as other observations incident to exploration of this kind. There is also a chapter on some Norwegian women, and one on the original occupants of the country, the Lapps, based on the writings of A. H. Keane. F. S. DELLENBAUGH.

Hill Towns in Italy. By Egerton R. Williams, Jr. xiv and 398 pp. With Illustrations from Photographs. Houghton Mifflin Company, Boston and New York. 8vo.

To describe without wearying repetition of phrase and detail no less than forty-three of those remarkable towns which crown the hills of Central Italy between Florence and Rome, and not only to hold the reader's attention through 400 pages but to inspire in him an eager desire to see for himself each and all, is a task of no small difficulty. Such a task well done is this work. It is a clear straight-forward account of his trip, specific enough to be of service to the traveller, and entertaining to him who must travel through books alone. Yet it is more than a traveller's tale, and ought not to be classed with many of that kind; for instead of the usual type, half personal adventure and amusing anecdote, half ill-balanced judgments of wonder and awe, we have here a sober and serious account of things as Mr. Williams found them in the Spring of 1903.

The hill towns may claim the attention of the traveller in three ways. As a geographer he may be interested in their natural setting, as an historian in their long extended and eventful history, or as an artist in their many art treasures. For the geographically minded, Mr. Williams describes with appreciation the strange situation of these towns on the hill tops, the beautiful Umbrian plain at their feet, the bleak highlands of Eturia with their characteristic ravines, and the rivers and passes of the Apennines, and he does not neglect to show how these geographical forms have conditioned the progress and decay of the towns. As his travelling was largely done in a carriage, a sense of the open road and of the oncoming of a beautiful Italian Spring pervades the account.

He is careful to recall those necessary facts of a long and momentous history which make the present remains of a town he is describing live again as in a more glorious past, a past which in many instances can be traced back of the days when Rome was young, to Etruscan times, or even, more ancient still, to Pelasgic days. The tremendous age of these city-centers of civilization, outlasting the empires which have successively governed them, is vividly impressed on the reader in the presence of some bit of ancient wall whose stones still stand as they were placed 4,000 years ago.

But to many the chief attraction of these little towns is the art treasures, more precious than many jewels, to which they form the setting and upon the presence of which they depend, now in their old age, for a livelihood. In this matter Mr. Williams has set forth his intention so well in his preface that I quote:

"It is impossible to speak of the hill towns without speaking of the works of the Renaissance that are bound into their lives. The lines of their palaces are their dress; the glowing tones of the old masters are the colors of their existence. I have tried to avoid profuseness and technicality, and to mention simply, enough of the artistic history of a place to put the reader *en rapport* with its life and appearance; and just enough of the characteristics of the chief painters and their works in the hill towns to show the difference between the Umbrian, Sienese, and Florentine schools, and to indicate the distinctive traits of the masters themselves."

Type and press-work are excellent. The map would be better with more distinct detail and with contour lines of elevation, but, as it is, enables one to follow the author in his wanderings. The thirty odd photographs illustrate so well, that one's only wish is for at least thirty more of the same excellent kind. That of S. Maria delle Pieve in Arezzo would be more useful if placed in the text descriptive of that town instead of Pienza; but errors of carelessness are few, and I have noted only the natural slip of *della* for *del Granduca* (page 221, repeated on page 224) when speaking of the Etruscan tombs near Chiusi,—Clusium it was when Lars Porsena went forth from its walls to do battle with Rome.

STEPHEN A. HURLBUT.

The Conquest of the Isthmus. The men who are Building the Panama Canal, Their Daily Lives, Perils and Adventures. By Hugh C. Weir. xiii and 238 pp., 32 Illustrations and Map. G. P. Putnam's Sons, New York, 1909. $2.

An interesting, popular, enthusiastic account of the trials and successes attending the digging of the Panama Canal. The chapters showing how the men are fed and housed, how the Zone is policed and how disease has been conquered, give intimate and impressive facts in reference to phases of the canal work that, hitherto, have been little understood in this country. Certain side issues as scorpions, tarantulas and alligators receive, perhaps, more prominence than is appropriate, for the story of the canal digging itself is thereby reduced to a minimum. In fact these phases of life on the Isthmus, which naturally attracted the interest of the writer, are so interlaced with the accounts of the actual engineering operations, that the reader feels a lack of continuity of treatment that is disappointing.

Facts are given from authoritative sources, but the statistics of progress as a whole and by month, close with August, 1908. So much has been done since

that date, and so many records for excavation have been established, that the volume does not seem sufficiently up-to-date.

Yet, if the reader will skip lightly over certain distressing descriptions of conditions in the early days, and will concentrate his attention on the more recent facts, the book will well repay reading. It is, however, not a book of reference and is popular in tone, rather than scientific. R. E. DODGE.

The Teaching of Geography. By William J. Sutherland. pp. 292 and Illustrations. Chicago, Scott, Foresman & Company, 1909. $1.25.

This is the latest addition to a phase of geography that is receiving much attention, but on which there are few inclusive contributions. The book is divided into three parts, entitled "The Nature and Scope of Geography," "The Teaching of Geography" and "Practical Suggestions." Part 1 is devoted to a discussion of certain phases of geography, with a view to bringing out the importance of an understanding of the reasons for human geographic conditions over the world. The author shows the relation of other subjects to geography and gives an excellent outline of the right point of view for the teacher, in two brief discussions of the geography of New England and of Illinois.

Part 2 discusses the necessary preparation of a teacher of geography, giving somewhat undue prominence to certain phases of physical geography, and includes a treatment of inductive and deductive lessons, together with certain other topics. The teacher who has acquired the author's point of view in reference to the scope and purpose of geography will find these outlines pertinent and helpful.

The third portion of the volume deals with the value and use of illustrative materials, of maps and models, and includes outlines for the study of weather and soils. The volume closes with an extensive—too extensive—bibliography and with a reference list for map equipment.

This outline does not give an adequate impression of the value of the volume. The author has done an important piece of work in making available for the average teacher what the better teachers have long been practicing. He has presented the value and importance of the human side of geography better than it has been presented before for teachers, in an inclusive way.

Yet the book lacks a certain strength in that it is discursive and the parts are not well knit together. Hence the thoughtful teacher will find the volume lacking in unity and incisiveness. In spite of these defects, however, the volume is a distinct addition to our literature on geography teaching, and the author deserves high praise for his success in helping elementary school teachers.

R. E. DODGE.

Robert Fulton and the "Clermont." The authoritative Story of Robert Fulton's Early Experiments, persistent Efforts and historic Achievements. Containing many of Fulton's hitherto unpublished Letters, Drawings and Pictures. By Alice Crary Sutcliffe. xv and 367 pp., 30 Illustrations. Appendix and Index. The Century Co., New York, 1909. $1.20 net.

This is an authoritative, interesting account of the life and engineering projects of Robert Fulton, culminating in a description of the famous Clermont and of its early trips on the Hudson. The writer is a great-granddaughter of the inventor. The volume contains many reproductions of pictures of people associated with Fulton, of Fulton himself, and of his various studies for steamboats.

The author has drawn on many sources for materials, not hitherto available, and has presented a volume that is timely and valuable. An appendix contains many reproductions of interesting letters from Fulton or in reference to his works, and a list of his paintings. R. E. DODGE.

Die Wanderungen der Polynesier nach dem Zeugnis ihrer Sprachen. Von Franz Nikolaus Finck. 4 chart diagrams. *Nachrichten* von der Königlichen Gesellschaft der Wissenschaften zu Göttingen, philologisch-historische Klasse, Heft 3, 1909.

The title would be more accurately stated as the secondary migrations of the Polynesians, for Prof. Finck deals entirely, save for one important exception, with the swarming of the Polynesian peoples from Samoa to the onward archipelagoes of the South Sea. For any such inquiry the material exists in two forms. The more obvious lies in the historical record preserved in the vast volume of tradition existing in every one of the eastward groups. The second is in the material remains preserved in the speech, fossils which yield to the research of the philological inquirer. For his inquiry both sources of information lay ready to hand. That he has wholly disregarded the former has deprived him of a series of valuable counterchecks which might have spared him several errors.

A central error vitiates his conclusions. A closer dissection of the languages of Nuclear Polynesia should have revealed to him the fact that the Polynesian tongue there exists in two widely separated stages of phonetic development. A brief review of Samoan traditions would have shown him that these phases of language mark the contours of two separate swarms of migration to Nuclear Polynesia, the elder denominated in my system the Proto-Samoan, the junior the Tongafiti. These traditions list the tale of the generations which elapsed between the Proto-Samoan occupation of Nuclear Polynesia and the coming of the Tongafiti swarm, and the generations are readily reducible to a round number of several centuries. This lapse of time, thus distinctly recorded, is equally manifest in the modification of the speech.

Neglecting this duality of the migration to Nuclear Polynesia, Prof. Finck is led into error by regarding the eastward migration out of Nuclear Polynesia as practically homogeneous. He finds only the later, the Tongafiti migration, and not all of that. Yet in my recent studies of the subject I have been able to establish distinctly a Proto-Samoan migration directly from Nuclear Polynesia to Hawaii on the north, to New Zealand on the south, and eastward to Tahiti and Mangareva, all upon a purely philological base and none discoverable in his method. The key is the fact of the two migrations separated by many centuries, and this key seems not to have been within his reach.

Of the primary migration, the courses of the two streams into Nuclear Polynesia, he has little to say. He proposes for the immediate approach to Samoa a voyage from Vaitupu, thence to Fakaofo, thence to Samoa. Yet the peopling of Fakaofo and Vaitupu is very modern, the languages represent almost the current stage of Samoan and the traditions make it very clear that wanderers from Samoa, in most modern centuries, provided the present population of these islands.

Though Prof. Finck has not gone into the material deeply enough to establish the true chart of the migrations of the two swarms, his work is of great interest and value and will serve as the base of future studies in which it will contribute to the elucidation of many problems which yet baffle solution.

WILLIAM CHURCHILL.

Reports of the Cambridge Anthropological Expedition to Torres Straits. Volume VI. Sociology, Magic and Religion of the Eastern Islanders. xx and 316 pp., Map and Illustrations. The University Press, Cambridge, 1908.

The sixth, and, in series, the final. volume of the reports of this very valuable and detailed study of the people of the islands of Torres Straits appears out of order, the first and fourth volumes being still under preparation. It deals wholly with the three small islands of Mer, Dauar and Waier and its extent is sufficiently shown by the subordinate volume title "Sociology, Magic and Religion of the Eastern Islanders." Inasmuch as Dauar and Waier are but outlying islets and scantily populated, Mer is the theatre of most of the information here recorded and the work might well have been distinguished as a study of the Miriam.

In fourteen chapters we are introduced to a knowledge of the Miriam through their folk-tales, genealogies, kinship, personal names, birth and childhood customs and the limitation of children, courtship and marriage, the regulation of marriage, funeral ceremonies, property and inheritance, social organization, trade, quarrels and warfare, magic, and religion; the several essays are credited to Dr. A. C. Haddon, Dr. W. H. R. Rivers, C. S. Myers and A. Wilkin.

All is very systematic, all very thorough and detailed. In fact it must be acknowledged that this volume is really the first introduction of the Miriam to the world. Where our debt is so great and our acknowledgment of that obligation is so frank, it seems out of place to suggest that the work might have been better done if there were more of it. This is by no means a matter of volume. The authors have apparently exhausted their capacities for research and have faithfully set down the most minute details. Objects have been measured with painful accuracy, places have been oriented, individuals have been checked up in the tables of the census of ancestors. All is very precise, most definite, the result is a museum of the Miriam.

At this point we incline to differ with the faithful recorders of this expedition. Not the lowliest of men may properly be considered a museum specimen to be set on end behind the glass of a row of cases until he has become a mummy or an anatomical preparation. Until the day of his death he moves so long as he lives and has his being, he is always manifesting his inner life and impressing it upon the outer world. The work in this volume is altogether external, a close record of things done and of objects made, very minute in the study of the result and very careful in the account of the manner of the doing and the method of the making.

But we look in vain for a note of the compulsive manhood that instigates the doing, that accomplishes the making. The anthropologist in the field should recognize that it is not enough to collect and to tag the external phenomena. With the elemental savage, above all, should he put himself in his place. His greatest duty is to get inside and to look out. In some of the dances of the esoteric cult among the Miriam it has been considered valuable to note that these steps and those are performed widdershins. The record is of great value. Some of its value we think has been obscured when it is explained that the motion is contrary to the movement of the hands of the clock. It diverts the interpretation from the solar sweep which was familiar to the Miriam before trade brought clocks to them. But the value would have been far richer if one of

these observers had been able to ascertain the reason which led the Miriam dancer to pursue this course.

Anthropological research may no longer be content with the record of the answers to its questionings of "What?", for there is always an underlying "Why?" to be answered. Anthropology without psychology must ever be a record of arid facts. The record may serve as material upon which the later student may grope his way into the soul of the men out of whom the facts have arisen. In far too many cases that must be our only material. How much easier it will be when the observer in the field puts life into his faithful fact record by adding no less faithful note of the psychology of the man under examination.

WILLIAM CHURCHILL.

The Geology of the Mikonui Subdivision, North Westland. By P. G. Morgan. New Zealand Geological Survey, Department of Mines, *Bull.* No. 6 (N. S.), pp. ix-175, 29 ills., 12 maps and 2 diagrams. Wellington, N. Z., 1908.

This report deals with a small area on the west side of South Island. Portions of the district are among the wildest in New Zealand and provisions, tents, instruments, etc., had to be carried into the remotest parts of the mountain ranges. Many miles of foot-paths had to be cut, streams forded and precipices scaled.

Of special interest is the section on bird-life which is unusually full. The one-sided contest between the imported pest, the weasel, and the flightless birds, is described, as also the extraordinary migrations of some of the flying birds which migrate from far northerly islands in the South Pacific to New Zealand. The cuckoo makes a journey, each year, of about 900 miles from land to land. The zones of tree growth are also described from an ecological stand-point. The principal industries of the district are grazing, with only the most trifling development of the growth of cereals and root-crops. Mining has become an important industry and the major part of the report deals with those geological features related to the development of this industry.

The alpine chain of North Westland is part of an ancient peneplain uplifted by mountain making movements to its present position. The western portion descends in an indistinct, step-like fashion to the shore, but along lines parallel to the main axis of the mountains the summits have accordant altitudes that suggest an ancient baselevel of erosion though it is not certain, from the detailed descriptions, whether this interpretation can be accepted without further analysis. The flat tops of the hills in the foot hills area are the most suggestive features mentioned in the discussion. While the report as a whole represents very careful work, attention may be called to the obscure passages relating to ice erosion, p. 46; and the ineffective analysis of Hanging Valleys, p. 55, where the phases "apparently" and "one must suppose" in critical places in the argument entirely invalidate the force of the discussion concerning the ability of ice to modify valley forms. One of the most interesting features is the overthrust of schist upon river gravels and its possible indication of very recent elevation of the New Zealand Alps (p. 72).

ISAIAH BOWMAN.

Chinese Immigration. By Mary Roberts Coolidge, Ph. D. x and 531 pp., and Index. Henry Holt & Company, New York, 1909. $1.75.

In 1892 the Geary bill, making it illegal for any Chinese, except diplomats

and their servants, to come or return to the United States, was introduced in Congress. In the exciting days of the discussion and the final passage of the exclusion law, Mrs. Coolidge began her studies of Chinese immigration. They were continued at Stanford University, and the data collected were used in the classroom as part of a course on Race Problems. The author's researches were finally completed with the assistance of the Carnegie Institution.

The book is an able and careful statement of fifty years of Chinese immigration into California, its social and economic results and the legislation it evoked. The author has collected and condensed in this volume all the significant events and movements that make the story of the influx of the Chinese and its consequences. The book has been written with thorough preparation and with perfect honesty and fairness.

That the author exhibits some warmth in speaking of the sufferings inflicted upon the Chinese by local politicians and mobs and by hostile and unfair legislation is not surprising and seems entirely justified by the documentary and other proofs adduced. Probably, the best national sentiment now fully endorses the conclusion which this book emphasizes, that a detestable policy towards the Chinese was adopted, and that not California alone, but the whole country was responsible for it.

The first chapter treats well of the characteristics of the Chinese people. About 100 pp. are given to the era of free immigration in the three decades from 1848 to 1882. Then follows the discussion of three decades of restriction and expulsion beginning in 1882. Under the head of "Competition and Assimilation" much information of economic interest and importance is presented in six chapters.

Time and its Measurement. By James Arthur. 64 pp. and 47 Illustrations. Reprinted from *Popular Mechanics Magazine,* Chicago, 1909.

Mr. Arthur is a successful inventor and an extensive traveller who has made a hobby of the study of clocks, watches and other time-measuring devices. He is an authority on this subject and his collection of 1,500 timepieces from all parts of the world is supposed to be the finest in existence. His description of the methods and appliances used in measuring time, from the earliest days, is full of curious matter and historic interest. The invention of time recording machines seems to have been brought about by the growing need of knowing the time at night, sun dials not being useful at that period of the day. The book is nearly equally divided between ancient and modern devices for telling the time.

History of New York Ship Yards. By John H. Morrison. 167 pp., 22 Illustrations, and Index. Scientific American Publishing Co., New York, 1909. $2.

This is a fruitful and an interesting theme and Mr. Morrison has adequately treated it. He tells the story of the development of New York ship yards from Colonial times and convinces the reader that the industry was once of far greater importance than it is to-day. He traces the development of wooden ship building in our country, describes the American clipper ship, records the time of some of its fastest voyages, and tells about dry docks, shipyard strikes, the formation of Trade Unions, launching of vessels and launching disasters and the causes of the decline of wooden shipbuilding. The work has evidently been prepared with care and accuracy.

Les derniers Jours de l'État du Congo. Par Emile Vandervelde, Professeur à l'Université Nouvelle. 198 pp. and Illustrations. Édition de la Société Nouvelle, Paris and Mons, 1909.

Prof. Vandervelde has been one of the ablest and severest critics, in the Belgian parliament, of policies that inflicted cruelty and injustice upon the black population of the Congo Free State. His visit to that country was only for three or four months, in the last days of the State before it became a Colony of Belgium; but he had studied the country so well, as a Belgian publicist, that he knew just what he wished to see, and his high position gave him unusual advantages for seeing a great deal in a short time. His book is simply the journal of his travels, a description of what he saw or learned on credible authority, with his own comments and suggestions. He saw much to commend and considerable to censure in the management of affairs during the last weeks of the old régime. He is especially severe upon the conduct of some of the government hospitals which he found in a disgraceful condition. On the whole, he saw great amelioration in the conditions that had oppressed the blacks. He found much that is hopeful in the prospects of the colony, for its resources are undoubtedly great and may be made a blessing to the natives and the whites. This book by a man of affairs, a keen observer and a good writer is one of the best that has recently appeared on the Congo.

Through the Yukon and Alaska. By T. A. Rickard. xiii and 392 pp., 175 Illustrations, 9 Maps and Index. Mining and Scientific Press, San Francisco, 1909. $2.50.

An interesting volume describing the author's experiences in travelling over 8,000 miles through Alaska and the Yukon district in 1908. The volume is not, however, merely a traveller's tale, for much attention is given to the history of development of the mining centers visited and to chronicling stories of the "early days" that have already become legends, so rapidly have events moved in the gold regions of Alaska in the last few years. The account begins with the start from Seattle and describes in turn Juneau, Sitka, Skagway, White Horse, Dawson, Fairbanks, St. Michael, Nome, and thence back to San Francisco. Other chapters describe the natives, the development of mining methods, the possibilities of Arctic agriculture and many other phases of life in Alaska that would ordinarily be neglected in a more technical account of the country.

The author is keenly alive to the beauties and to the hardships of life in the far north, has a thorough understanding of mining methods and knows the geology of the area through its literature. He has refrained from including details of a scientific nature, however, except where such details are necessary for the purposes of his book. He has presented an attractive account of human conditions in the mining sections of the far north and has recorded many phases of life that are rapidly being superceded.

As a contribution to the history of the Alaskan gold rush and as a statement of conditions as they existed in 1908, the volume deserves a place of importance in the literature dealing with the areas described.

An Outline Review of the Geology of Peru. By G. I. Adams. The Smithsonian *Report* for 1908, pp. 385-430, with plates 1-5, Washington, D. C., 1909.

Mr. Adams was employed by the Peruvian Government for hydrologic studies.

The results of several years' labor have appeared in detail in various bulletins of the Corps of Engineers of Mines, Peru. In addition to these excellent reports there is now supplied in this important paper a résumé in English of the results of geologic investigation in Peru from the earliest times. The value of the résumé may be judged by the fact that it includes the essentials of many publications not only in Spanish but also in English, German and French, the interpretations from these sources being controlled by the personal observations of the author.

Of special merit are the maps appended to the text. These are five in number, representing not only the general outline features of the relief of the country but also, in a set of four detailed maps, the hydrography of the coastal region all the way from Paita in northwestern Peru to Tacna on the south. On these maps also appear the approximate boundaries between the region of general rainfall and the arid region of the coast in the lee of the mountains. There is also brought out the distinction between the various sub-regions of the coast.

There are three coastal plain tracts where irrigation is extensively practiced and, intervening, are two mountain tracts in which are a number of irrigated valleys whose lower courses are irrigated but whose upper courses, "the heads of the valleys," are too steep and rocky for cultivation. All told, the coastal valleys of Peru are some thirty in number and constitute the richest agricultural sections of Peru. The writer discusses the evidence for the three-fold subdivision of the Andes of Peru which extend in roughly parallel chains from the Knot of Vilcanote to the Marañon, except where the ranges unite at the Knot of Cerro de Pasco; and presents a sketch of the growth of knowledge concerning the nature of the mountains, their extent, natural classification, and drainage. A number of approximate cross-sections illustrate the structural features of the coastal plains and mountains and also the Andes. Climatological data are included for Lima, Ica, and Cailloma. An unusually complete and useful bibliography completes the article. It is a matter for congratulation that we now have in English this extremely valuable paper on the general geology of Peru.

ISAIAH BOWMAN.

The Mississippi. Report by a special Board of Engineers on Survey of the Mississippi River from St. Louis, Mo., to its mouth with a view to obtaining a channel 14 feet deep and of suitable width. 532 pp., Maps and Atlas. Submitted by the Chief of Engineers to the Secretary of War. 61st Congress, 1st Session, House Doc. No. 50. Gov. Print. Off., Washington, 1909.

This report embodies many of the conclusions reached by students of the Mississippi and supplies, in addition, much new material. The interesting part of it is the discussion of methods for obtaining and maintaining the 14-foot channel. The Board names seven: dredging, regularization, canalization with movable dams, canalization with fixed dams, lateral canals, reservoirs and a combination of methods.

With regard to improvement by reservoirs, the Board decides that such a method is, for the present at least, impracticable. This conclusion is based first, upon the study of storage reservoirs above St. Paul, the effects of which would not extend south of Lake Pepin, 51 miles below St. Paul; second, the length of time it would take for the released water to be effective at St. Louis, this time, for reservoirs above St. Paul, being at least two months, which interval would

make forecasts impossible; third, the amount of water which would have to be impounded in order to attain a 14-foot depth at St. Louis, an amount about ten times what has yet been found possible.

The Board reaches the conclusion "that the most practicable method of obtaining and maintaining a navigable channel of 14 feet deep from St. Louis to Cairo is by the completion of the project of 1881 for partial regularization in such way as to secure a permanent controlling depth of 8 feet, and then to rely upon dredging for securing and maintaining any further increase of depth." While a 14-foot waterway is considered practical, the desirability of it is questioned on the grounds that lake and ocean vessels could not navigate the channel which is tortuous and, at times, swift; nor would such a depth be sufficient for a loaded freighter. It is furthermore implied that the best use of the river will be realized by using special river barges having a draft of not more than 9 feet; these barges will be capable of carrying all the freight now seeking a water highway at a cost comparable to that of other means of transportation; and a 9-foot regulated river is easily within the range of a moderate expenditure and a small maintaining corps.

Another common argument is rebutted in this volume by the assertion that the decline in the commerce of the river has not arisen from the lack of a navigable channel for vessels of large draft but from the reduction in amount of material available for shipment. The shifting of the centers of output in recent years will explain the falling off in the river commerce.

The investigation of this problem of river conservation and use has been undertaken with great care and thoroughness, and the latitude of the work may be comprehended from the reports on many allied topics, such as, the physical characteristics of the Mississippi river, past and present projects for improvement, present and prospective commerce, gauge readings and discharge measurements. The discussion of that part of the report of the committee on Rivers and Harbors (H. R. 20686, 61st Congress) which pertains to the Mississippi river, before the present Congress, is not intelligible without a knowledge of this report.

With the report is published a large atlas which contains many maps of the river on which are plotted the projects discussed, and in addition, a wealth of data in hydrographs, profiles and typical cross-sections. R. M. Brown.

My Life in China and America. By Yung Wing. vi and 286 pp., Appendix and Index. Henry Holt & Company, New York, 1909.

The autobiographical details of this most interesting volume illuminate the upbuilding of the oldest of the nations, and in the illumination the personal details sink into the background. Those of us who know Yung Wing will find a pleasure in reading this simple story of his struggle out of the Orient into the stream of the advance of our culture. It is a pathetic tale, its personal interest is very great.

But when we seek to examine this personal accomplishment of one Chinaman against the background of the tradition and conservatism of the Middle Kingdom, we see in one glance how great was his accomplishment and then we lose sight of the individual. In the glow of his accomplishment he is lost to view.

Briefly put the record is that Yung Wing came to this country, overcame all obstacles almost with no helping hand, took high place at Yale and, in his

acquaintance with American thought and Occidental culture, became of value to the Dragon Throne. Had it been given to him to return to China and remain with his new stores of knowledge he might readily have progressed through the line of preferment to yellow jacket and peacock plume and bright red button of the advancing mandarin.

But for China he was most useful in the capacity of pioneer. He had won his way through great hardship and he had accomplished much. Awaking China determined that youth selected from her best should attain to at least as much, and that the accomplishment should be without the hardship that had hampered her pioneer, though no difficulty could do more than delay him. He was commissioned to remain away from his home for many long years. He was to serve as, in some sort, a scholastic consignee to whom were despatched from time to time invoices of Chinese youth for education in the great West. Yung Wing's first duty was to make such provision for the young students sent from home into the unknown system of an alien civilization that there should be none of the hardship through which he had so painfully made the track. A second duty was to see to it that the years of study in a culture non-Confucian should not rob the Middle Kingdom of the heart of her young sons who were sent into what many considered the land of devils, sent at the age of the greatest facility in receiving impressions.

In this autobiography Yung Wing is characteristically modest. He does not give us to see how well he performed this task of double difficulty. That omission is not difficult to supply. Many of us, a generation ago, were thrown at college into the chance of intimate acquaintance with Yung Wing's boys. We could estimate them in the classroom and in the hours of recreation and we found them no laggards in either. When they had reached the dignity of the American degree they went home to take up the work of China. But Yung Wing remained, an exile of service, to take still newer boys and to fit them to hold their own in competition with American youth. He lived far from the honors and the preferments of the Throne, devoting his life and his powers to fitting others for the honors which he would so well himself have adorned.

And at the other end, we have record of Yung Wing's accomplishment. China gave him Chinese boys to train, to China returned, from his hand, men of Western education, better Chinese. These are now men of fifty, they have served their state in high capacity and they have earned honors. The alumni rolls of our colleges show what they have done. They have become mandarins in rank, governors and ambassadors and generals in service, leaders all and not a one caught in the swirl of palace intrigue.

It is just as well not to forget that Yung Wing made these men. It is in their honors that his reward must be sought. WILLIAM CHURCHILL.

Court Life in China. The Capital, its Officials and People. By Isaac Taylor Headland. 372 pp., Illustrations, and Index. Fleming H. Revell Company, New York, 1909. $1.50.

Prof. Headland has seen the portal of the Forbidden City open and he has walked in, his eyes have rested upon the abode of the puppet emperor and of that masterful woman who for half a cycle of Cathay stood out as the one great figure. He and his wife, for not the least instructive chapters of the volume are credited to Mrs. Headland's note book, have opened, in friendly intercourse, the

equally forbidden doors of the homes of great princes. An unexampled opportunity, but the result is somewhat disappointing. It is as though the doors set wide disclosed an inner screen; we do not seem to glimpse, far less gaze into, the life which lies behind the gate and on the other side of the screen.

The first third of the volume is taken up with the account of the Dowager Empress. These chapters are essays in interpretation of the character of a woman who made herself great in a community where women are small. There is dearth of facts which might serve as data. There is a marked lack of the power to penetrate into the heart of a society whose ethics, minor as well as major, differs in externals so widely from our own. Prof. Headland's essays are illuminative. They present a picture of the empress with a wealth of detail such as is exhibited in no other record. The same is to be said of the three chapters on the emperor Kuang Hsü. Yet we must recognize that the illumination is but a brighter glow of light upon the superficies; the two great figures may photograph better, the result is after all but a photograph and not a portrait. The baffled investigator of such an alien culture may make his peace with his conscience by reciting the chant of east and west that never shall the twain meet, a confession of failure. Prof. Headland shows himself an admirer of the empress, but that her character has baffled his understanding is manifest in his inability to account for her stand in the Boxer troubles, that conservative reaction of old China against the new life felt upon the fringes of the empire.

In the present epoch of the Middle Kingdom, an infant making the sacrifices to the ancestors, and a regent reigning in his name, this book will certainly remain for some time the source whence will be derived much of our Western acquaintance with names at present great. How long they will remain great it is impossible to foretell. The gates of the home of the Manchu princes have closed, the doors of the Forbidden City have snapped shut, and always behind them remains that screen which decorates so much, hides so much. Yet before the closing of the doors, Prof. Headland has drawn a helpful sketch of Prince Chun, the regent, upon whom so much will depend. With riper appreciation, probably by reason of the greater opportunity for free acquaintance, he has sketched the career of Yüan Shih-kai. He indulges himself in the hope that his career is not ended by his retirement to a far province to nurse a rheumatism in the leg. Before that sentence was pronounced upon him he was suspected of the murder of Kuang Hsü. Before that again he was a leader of a liberal China.

WILLIAM CHURCHILL.

Rocky Mountain Wild Flower Studies. An account of the Ways of some Plants that Live in the Rocky Mountain Region. By Burton O. Longyear. xv and 156 pp., Illustrations from Nature, by the Author, and Index. Author's Edition, Fort Collins, Col., 1909. [The author, professor of botany in the State Agricultural College of Colorado, tells the story here of a considerable number of the Rocky Mountain plants. He is an enthusiastic naturalist, his talks are written *con amore* and make pleasant and edifying reading. They will help teachers to teach, and pupils and general readers to learn the ways of plants.]

The Lure of the Indian Country and a Romance of its Great Resort. By Oleta Littleheart. 145 pp. and many Photo-engravings. A. Abbott, Sulphur,

Oklahoma. Leather, $1.; paper, 25c. [No harm at all, but it was not necessary to weave even a true love story into this interesting narrative of the passing of the old régime in the Indian Territory and its absorption as a part of the lusty state of Oklahoma. The author gives the history of that momentous period of the transformation, of the rise of the astonishing little city of Sulphur, of the resources that bless the land, and reveals much of the inner life and ambitions of the Five Tribes. She is a daughter of this Indian country, knows what she describes and tells her story vivaciously.]

Times of Sunrise and Sunset, in the United States. By Robert Wheeler Willson, Professor of Astronomy in Harvard University. Harvard Coöperative Society, Cambridge, 1908. $1.25. [A series of 48 maps plates, four for each month, each containing two maps, the upper to be used for finding the standard time of sunrise for the date at the head of the page, the time of sunset being found from the lower map. Simple rules are given for using the maps. Away from large towns, this work should often serve a useful purpose.]

Visitors' Guide to Westminster Abbey. By Francis Bond. 93 pp., 12 plans, 36 photographs and other Illustrations. Henry Frowde, Oxford University Press, London & New York, 1909. 1s. [A little book for the pocket dealing chiefly with the monuments and other objects of interest in the church and cloisters. Especially adapted for visitors who have only limited time.]

Wie sollen unsere Mittelschüler die Alpen bereisen? Technische Anleitungen und wissenschaftliche Anregungen von Ernst Enzensperger. 123 pp., Illustrations and Bibliography. Jos. Kösel'sche Buchhandlung. Kempten u. München, 1909. M. 1.50. [Especially intended for students of the secondary schools who wish to pursue geological or other earth or meteorological studies in the Alps, or to observe the influence of Alpine conditions upon the human inhabitants. A good example of an elementary scientific guide for field observations.]

Drumkey's Year Book for East Africa. 1909. Being a complete Calendar, Directory and Gazetteer for the British East Africa and Zanzibar Protectorates, and containing Infomation about Uganda and German East Africa. By Y. S. A. Drumkey. vi and 394 pp., and 2 Maps. Nairobi General Agency, Nairobi, British East Africa, 1909. [A compendium of information on the regions treated and indispensable to business men, tourists and sportsmen in tropical East Africa.]

Das alte Rom. Sein Werden, Blühen und Vergehen. Von Dr. Ernst Diehl. 126 pp, Illustrations, Maps and Index. Quelle & Meyer, Leipzig, 1909. M. 1.25. [The author, a professor in Jena University. gives here a concise and clearly written description of the situation, surface features and climate of Rome, the development of the ancient city and the characteristic buildings of the royal, republican and imperial epochs, illustrated by a series of photographic views or drawings and maps.]

Norway, Sweden and Denmark with Excursions to Iceland and Spitzbergen. Handbook for Travellers by Karl Baedeker. Ninth Edition, Revised and Augmented. lx and 468 pp., 43 Maps, 26 Plans and several Panoramas. Karl Baedeker, Leipzig, and Charles Scribner's Sons, New York, 1909. M. 8. [A Summary of the Norwegian and Swedish grammars with vocabularies and lists of phrases is appended. This English edition is of great convenience to

American tourists. Heights are given in feet in the text, and in meters on the maps.]

A Paper on the Ordnance Survey. By Col. Sir Duncan Alexander Johnston, late Director-General of the Ordnance Survey. With discussion. Reprint from *Trans.* of The Surveyors' Institution, Vol. 41, Part 5, pp. 155-198, London, 1909. [Gives a brief, historical sketch of the Ordinance Survey and then treats especially of the cadastral or large scale maps which form the basis of the topographical maps. It gives a full insight into the care used in preparing, and ensuring the accuracy of the Ordnance maps.]

CURRENT GEOGRAPHICAL PAPERS

AMERICA

AMERICA. Emigrazione e Colonie. Raccolta di Rapporti dei Agenti Diplomatici e Consolari. Min. degli Affari Esteri, Com. dell' Emigraz., Vol. 3, 470 pp., Rome, 1909.

NORTH AMERICA

United States

COSTANSÓ, D. MIGUEL. The Narrative of the Portola Expedition of 1769-1770. [First book relating exclusively to California reprinted with English translation from the Spanish.] *Pub.* Acad. of Pacific Coast His., Vol. 1, No. 4, 69 pp., Berkeley, Cal., 1910.

GANNETT, S. S., AND D. H. BALDWIN. Results of Spirit Levelling in Illinois 1896 to 1908. [All results of spirit levelling in Illinois are included.] *Bull.* 421, U. S. Geol. Surv., 74 pp. and Index, Washington, 1910.

GRIMSLEY, G. P. Clays, Limestones, and Cements. West Virginia Geol. Surv., Vol. 3, 565 pp., Maps, Ills., and Index, 1905.

GRIMSLEY, G. P. Iron Ores, Salt and Sandstones. West Va. Geol. Surv., Vol. 4, 603 pp., Maps, Ills. and Index, 1909.

GRIMSLEY, G. P. Ohio, Brooke and Hancock Counties, West Va. [History, Physiography, Geology, Economic Resources, Climate and Soil Surveys.] County Reports 1906, West Va. Geol. Surv., 378 pp., Ills., Index, and Maps in Atlas, 1906.

HAZARD, D. L. Results of Observations made at the Coast and Geodetic Survey Magnetic Observatory at Sitka, Alaska, 1905-1906. Coast and Geodetic Surv., 115 pp. and Diagrams, Washington, 1910.

HENNEN, R. V. Marshall, Wetzel and Tyler Cos., W. Va. [History, Physiography, Geology, Mineral Resources, Soil Survey and Levels above Mean Tide.] *County Reports,* West Va. Geol. Surv., 654 pp., Ills., Index and Maps in Atlas, 1909.

HOUGHTON, F. Indian Village, Camp and Burial Sites on the Niagara Frontier. Maps and Ills. *Bull.* Buffalo Soc. of Nat. Sci., Vol. 9, No. 3, pp. 261-374, 1909.

LUTHER, D. D. Geology of the Auburn-Genoa Quadrangles. *Bull.* 137, N. Y. State Museum, 36 pp., Map and Index, Albany, 1910.

MATTHEW, W. D. The Carnivora and Insectivora of the Bridger Basin, Middle Eocene. *Memoirs* Amer. Mus. Nat. His., Vol. 9, Part 6, 567 pp., Ills. and Index, New York, 1909.

MITCHELL, G. E. A New National Park. [Glacier National Park, Montana.] Ills. *Nat. Geog. Mag.*, Vol. 21, No. 3, pp. 215-223, 1910.

NELSON, N. C. Shellmounds of the San Francisco Bay Region. Map and Ills. *Univ. of Cal. Pub. in Amer. Archaeol. and Ethnol.*, Vol. 7, No. 4, pp. 309-348, Berkeley, Cal., 1909.

RANSOME, F. L., W. H. EMMONS AND G. H. GARREY. Geology and Ore Deposits of the Bullfrog District, Nevada. *Bull.* 407, U. S. Geol. Surv., 130 pp., Maps, Ills. and Index, Washington, 1910.

ROBERTS, T. G. The Merchant Marine and the Navy. *Proc.* U. S. Naval Instit., Vol. 36, No. 1, pp. 1-39, 1910.

SCHULTZE, DR. ERNST. Menschenschmuggel und gelbe Gefahr in den Vereinigten Staaten. Reprint from *Zeitsch.* für die gesamte Staatswissens, Vol. 66, No. 1, pp. 135-144, 1910.

WHITE, I. C. Levels Above Tide. West Va. Geog. Surv., Vol. 2, pp. 1-76, and Table of True Meridians, Morgantown, 1903.

WHITE, I. C. Petroleum and Natural Gas. West Va. Geol. Surv., Vol. 1 (a), pp. 1-557 and Index, 1904.

WHITE, I. C. Precise Levels. Elevations Above Tide. West Va. Geol. Surv., Vol. 1 (a), pp. 558-615, 1904.

WHITE, I. C. Report on Coal. West Va. Geol. Surv., Vol. 2, pp. 81-725, and Index, 1903.

WHITE, I. C. Supplementary Coal Report. West Va. Geol. Surv., Vol. 2 (a), 720 pp., Map in pocket, and Index, 1908.

—— Bulletin of Revenues and Expenses of Steam Roads in the U. S.. Interstate Com. Commission, Nos. 5-11, 1909, Washington, 1909 and 1910.

—— Decisions of the U. S. Geographic Board, March 2, 1910.

Canada

COLLINS, W. H. A Geological Reconnaissance of the Region Traversed by the National Transcontinental Railway between Lake Nipigon and Clay Lake, Ontario. Dep. of Mines, Geog. Surv. Branch, No. 1059, 67 pp., Ills., Maps and Index, Ottawa, 1909.

FALCONER, R. A. The Individuality of the Canadian People. John Hopkins Univ. *Cir.*, No. 3, 59 pp., Baltimore, 1910..

MACKINNON, W. A. The Canadian Fruit Industry. *United Empire*, Vol. 1 (New Series), No. 1, pp. 20-35, 1910.

MACOUN, JOHN AND JAMES M. Catalogue of Canadian Birds. Canada Dep. of Mines, Geol. Surv. Branch, No. 973, 761 pp. and Index, Ottawa, 1909.

—— Geographic Board of Canada. Decisions Feb., 1910. 6 pp., Ottawa, 1910.

CENTRAL AND SOUTH AMERICA

Guatemala

—— Kolonistenleben in Guatemala. *Mitt.* d. Ostschweiz. Geog. Commerc. Gesells. in St. Gallen, No. 2, pp. 97-107, 1909.

—— Legge 30 aprile 1909, sull' immigrazione nella Repubblica del Guatemala. *Boll.* dell' Emigrazione, No. 1, pp. 35-41, Rome, 1910.

Argentina

KEIDEL, H. Über die Geologie einzelner Teile der argentinischen Anden. *Stitzungsb,* d. k. Akad. d. Wiss., Math.-Naturw. Klasse, Vol. 117, Nos. 9 and 10, pp. 1327-1336, Vienna, 1908.

LALOY, DR. L. Ethnographie du haut plateau argentin. *La Géog.,* Vol. 21, No. 3, pp. 169-175, Paris, 1910.

STAPPENBECK, R. Geologische Beschreibung der Umgebung des Sees Musters in Patagonien. Map and Ills. *Sitzungsb.* d. k. Akad. d. Wiss., Math.-Naturw. Klasse, Vol. 117, Nos. 9 and 10, pp. 1243-1249, Vienna, 1908.

Bolivia

CRESPO, L. S. El Territorio Nacional de Colonjas. *Bol.* de la Soc. Geog. de la Paz, Vol. 7, Nos. 27-29, pp. 25-60, 1909.

Brazil

DERBY, O. A. The Northeast Coast of Brazil in Ancient Cartography. Reprinted from *Science,* Vol. 19, No. 487, pp. 681-694, April 29, 1904.

Peru

LORRIE, W. SCOTT. Sheep Raising in Peru. Ills. *Peru To-Day,* Vol. 1, No. 11, pp. 21-24, Lima, 1910.

MARSTERS, V. F. Informe sobre la Costa sur del Ptru. *Bol.* del Cuerpo de Ingen. de Minas, del Peru, No. 70, 112 pp., Map and Ills., Lima, 1909.

AFRICA

HAHN, DR. FR. Tierschutz in Afrika. *Pet. Mitt.,* Vol. 56, No. 3, pp. 141-142, 1910.

Egypt

DOWSON, E. M. Measurement of the Volumes Discharged by the Nile during 1905 and 1906. Map and Diagrams, Surv. Dep. Egypt, Paper No. 11, 82 pp., Cairo, 1909.

HUME, W. F. The Distribution of Iron Ores in Egypt. Surv. Dep. Egypt, Paper 20, 16 pp. and Map, Cairo, 1909.

LYONS, CAPT. H. G. The Rains of the Nile Basin and the Nile Flood of 1908. Surv. Dep. Egypt, Paper No. 14, 69 pp. and Maps, Cairo, 1909.

MAGNAGHI, PROF. A. Il Golfo di Suez e il Mar Rosso in una Relazione inedita di Filippo Pigafetta (1576-77). *Boll.* della Soc. Geog. Ital., Vol. 11, No. 2, pp. 145-177, and No. 3, pp. 284-312, 1910.

PALLARY, P. Catalogue de la Faune malacologique de l'Égypte. *Mémoires* présentées à l'Institut Égyptien, Vol. 6, No. 1, 89 pp., and Ills., Cairo, 1909.

STRAKOSCH, S. Ein Beitrag zur Kenntnis des photochemischen Klimas von

Ägypten und dem ägyptischen Sudan. Diagrams. *Sitzungsb.* d. k. Akad. d. Wissensch., Math.-Naturwissens. Klasse, Vol. 117, Nos. 9 and 10, pp. 1195-1212, Vienna, 1908.

—— A Report on the Work of the Survey Department in 1908. Ministry of Finance, Surv. Dep., Egypt, 88 pp. and Maps, Cairo, 1909.

Eritrea

BOSELLI, G. E. Nota sul Commercio della Colonia-Eritrea. *Bib.* di Studi Col., Ist. Col. Ital., No. 1, 22 pp., Rome, 1910.

Belgian Congo

—— La Conférence de la frontière orientale du Congo belge. Map. *Le Mouv. Géog.*, Vol. 27, No. 8, p. 107, 1910.

—— Les Gisements miners du Katanga. Map. *Le Mouv. Géog.*, Vol. 27, No. 8, p. 103, 1910.

French Congo

TILHO, JEAN. Le Tchad et les pays-bas du Tchad. Map. *La Géog.*, Vol. 21, No. 3, pp. 149-168, Paris, 1910.

French West Africa

DELAFOSSE, M. Monographe Historique du Cercle de Bamako. Maps and Ills. *Renseign. Col.*, Vol. 20, No. 3, pp. 57-67, 1910.

German East Africa

RICHELMANN. Daressalam. Plan and Ills. *Deutsche Kolonialz.*, Vol. 27, No. 6, pp. 88-90, 1910.

German Southwest Africa

FISCHER, H. Das deutsche Ovamboland. Ills. *Deutsche Rundschau*, Vol. 32, No. 5, pp. 197-205 and No. 6, pp. 259-263, 1910.

South Africa

HOWARD, A. G. The Rainfall of South Africa. *Trans.* Royal Soc. of South Africa, Vol. 1, Part 2, pp. 363-390, 1910.

STANFORD, W. E. Statement of Silayi, with Reference to his Life among the Bushmen. *Trans.* of the Royal Soc. of South Africa, Vol. 1, Part 2, pp. 435-440, 1910.

TOIT, A. L. DU. The Evolution of the River System of Griqualand West. Map. *Trans.* of the Royal Soc. of South Africa, Vol. 1, Part 2, pp. 347-361, 1910.

—— Basutoland. *Österr. Monatsschr. f. d.* Orient, Vol. 36, No. 2, pp. 20-21, 1910.

Tunis and Morocco

LE BOEUF, J. Note sur la Situation économique du Sud de la Régence de Tunis et sur l'Avenir de cette Région. *Bull.* Section Tunis de la Soc. de Géog. Comm. de Paris, No. 2, pp. 92-144, 1909.

MONTALEMBERT, A. DE. L'agriculture et l'élevage au Maroc. Rapport au Comité du Maroc (1907). *Renseign. Col.*, Vol. 20, No. 3, pp. 71-76, Paris, 1910.

—— L'industrie Alfatière en Tunisie. *Bull.* Section Tunisienne Soc. Géog. Com. de Paris, No. 2, pp. 145-151, 1909.

ASIA

Asiatic Turkey

OSWALD, DR. FELIX. Zur tektonischen Entwicklungsgeschichte des armenischen Hochlandes. Map and Diagrams. *Pet. Mitt.*, Vol. 56, No. 1, pp. 8-14, and No. 3, pp. 126-132, 1910.

THOMPSON, R. C. Tavernier's Travels in Mesopotamia. Ills. *Scott. Geog. Mag.*, Vol. 26, No. 3, pp. 141-148, 1910.

Central Asia

SCHULTZ, A. v. Vorläufiger Bericht über meine Pamir Expedition 1909. *Pet. Mitt.*, Vol. 56, No. 3, pp. 140-141, 1910.

China

PARKER, E. H. China's Progress. *The Imp. Asiatic Quarterly Rev.*, Vol. 29, No. 57, pp. 118-135, 1910.

—— Kiaotschau. *Österr. Monatsscrift f. d. Orient*, Vol. 36, No. 2, pp. 19-20, Vienna, 1910.

Dutch East Indies

DANES, DR. J. V. Die Karstphänomene im Goenoeng Sewoe auf Java. Map. *Tijdsch.* Kon. Ned. Aardrijksk. Genoots., Vol. 27, No. 2, pp. 247-260, 1910.

—— De Monding der Sadang-Rivier (Centraal-Celebes). Map. *Tijds.* Kon. Ned. Aardrijksk. Genoots., Vol. 27, No. 2, pp. 320-322, Leyden, 1910.

India

CHATTERJEE, ATUL CHANDRA. The Need and Methods of Industrial Development in India. *Imp. Asiat. Quart. Rev.*, Vol. 29, No. 57, pp. 24-45, 1910.

Indo-China

COLSTON, E. J. Some Recent Social Movements in Burma. *Imp. Asiatic Quart. Rev.*, Vol. 29, No. 57, pp. 68-87, 1910.

REUBEL, M. La Colonisation en Annam. *Bull.* Section Tunisienne, Soc. de Géog. Com. de Paris, No. 2, pp. 152-160, 1909.

RUMILLY, G. Étude sur la guerre contre les pirates au Tonkin (1909). *L'Asie Franç.*, Vol. 10, No. 107, pp. 84-93, 1910.

Japan and Korea

LLOYD, PROF. A. The Study of Things Japanese: Scope, Aims, Methods. *Trans.* of Asiat. Soc. of Japan, Vol. 37, Part 1, pp. 115-122, 1909.

MITFORD, E. BRUCE. The Active Volcanoes of Japan. *Trans.* Asiatic Soc. of Japan, Vol. 37, Part 1, pp. 87-112, 1909.

NACHOD, DR. O. Zur Kartographie Japans. *Zeitsch.* d. Ges. für Erdk. zu Berlin, No. 3, pp. 196-204, 1910.

ROSSI-TOESCA, V. I Diritti del Giappone sulla Corea. Istit. Col. Ital., No. 2, 27 pp., Rome, 1910.

Philippine Islands

GRIFFIN, L. E. A List of Snakes Found in Palawan. *Phil. Jour. of Sci.*, Vol. 4, No. 6, pp. 595-601, Manila, 1909.

SEALE, ALVIN. New Species of Philippine Fishes. Ills. *Phil. Jour of Sci.*, Vol. 4, No. 6, pp. 491-541, Manila, 1909.

Siberia

—— *K istorii zasielenia Sibiri.* [History of Influx of Population into Siberia.] *Izviestiia* Siberian Branch, I. R. Geog. Soc., Vol. 39, 1-9, 1910.

—— *Nujdy Sibiri.* [The Needs of Siberia.] *Izviestiia* Archangel Soc. for Explor. of Northern Russia, Vol. 2, No. 6, pp. 20-27, 1910.

AUSTRALASIA AND OCEANIA

BERNAYS, C. L. The British Solomon Islands. *Queensland Geog. Jour.*, (New Series), 24th Session, Vol. 24, pp. 26-42, 1908-9.

DEPEW, C. M. Hawaii. 13 pp., Washington, 1910.

RECHINGER, DR. KARL. Botanische und zoologische Ergebnisse einer wissenschaftlichen Forschungsreise nach den Samoainseln, dem Neuguinea-Archipel und den Salomoninseln von März bis Dez. 1905. Part 2. Ills. *Denkschriften* d. k. Akad. d. Wiss., Mathem.-Naturwiss. Klasse, Vol. 84, pp. 385-562, 1909.

REIBER, P. JOS. Eine geologische Expedition in das Toricelligebirge (Kaiser-Wilhelm-Land). Map. *Pet. Mitt.*, Vol. 56, No. 2, pp. 78-80 and 3, pp. 132-133, 1910.

WEEL, K M. VAN. Verkenning van Rivieren Tusschen Oost-Baai en Digoel-River (Zuid Nieuw-Guinea). Map *Tijdschr.* Kon. Nederl. Aardrijksk. Genoots., Vol. 27, No. 2, pp. 323-328, 1910.

—— Australia. *United Empire,* Vol. 1 (New Series), No. 1, pp. 52-56, 1910.

—— Western Australia. Report of the Surveyor-General for the Year ending 30th June, 1909. 18 pp., Map. Perth, 1909.

EUROPE

SUPAN, ALEXANDER. Die Bevölkerung der Erde. XIII. Europa. Map. *Ergänzungsheft No. 163, Pet. Mitt.*, 144 pp., Gotha, 1909.

Austria-Hungary

CONRAD, DR. VIKTOR. Die zeitliche Verteilung der in den österreichischen Alpen-und Karstländern gefühlten Erdbeben in den Jahren 1897 bis 1907. Ills. *Mitt. d.* Erdbeben-Kommission k. Akad. d. Wissensch. in Wien. No. 36, 23 pp., 1909.

DEFANT, DR. A. Berg-und Talwinde in Südtirol. Illls. *Sitzungsb.* d. k. Akad. d. Wiss., Math.-Naturw. Klasse, Vol. 118, No. 5, pp. 553-604, Vienna, 1909.

DEFANT, DR. A. Innsbrucker Föhnstudien II. Periodische Temperaturschwankungen bei Föhn und ihr Zusammenhang mit stehenden Luftwellen. Diagrams. *Denkschriften* d. k Akad. d. Wiss., Math.-Naturw. Klasse, Vol. 80, pp. 107-130, Vienna, 1907.

HOERNES, RUDOLF. Der Einbruch von Salzburg und die Ausdehnung des interglazialen Salzburger Sees. Profile, *Sitzungsb.* d. k. Akad. d. Wissens., Math.-Naturwissens. Klasse. Vol. 117, Nos. 9 and 10, pp. 1177-1193, Vienna, 1908.

IONESCU, CAPT. M. D. Formarea Deltei Dunării. Map. *Bull.* Soc. Geog. Română, Vol. 30, No. 1, pp. 26-50, Bucharest, 1909.

NOË, DR. FRANZ. Bericht über das Erdbeben vom 19 Februar, 1908. 2 Maps. *Mitt.* d. Erdbeben-Kommission d. k. Akad. d. Wissens. in Wien, No. 34, 16 pp., 1908.

SCHNEIDER, DR. R. Über die pulsatorischen Oszillationen (mikroseismische Unruhe) des Erdbodens im Winter 1907/1908 in Wien. *Mitt.* d. Erdbeben-Kommission k. Akad. d. Wissens. in Wien, No. 35, New Series, 45 pp. and 6 Ills. Vienna, 1909.

Balkan Peninsula

ADAMOVIC, PROF. DR. L. Die Pflanzengeographische Stellung und Gliederung der Balkanhalbinsel. Maps. *Denkschriften* d. k. Akad. der Wissens. Math.-Naturw. Klasse, Vol. 80, pp. 405-495, Vienna, 1907.

HOERNES, RUDOLF. Die Bildung des Bosporus und der Dardanellen. *Sitzungsber.* d. k. Akad. der Wiss. Math.-Naturwiss. Klasse, Vol. 118, No 6, pp. 693-758, Vienna, 1909.

VETTERS, DR. H. Beiträge zur Geologischen Kenntnis des nördlichen Albaniens. Map and Ills. *Denkschriften* der k. Akad. d. Wissens., Math.-Naturwiss. Klasse, Vol. 80, pp. 201-248, Vienna, 1907.

—— List of Works in the N. Y. Public Library Relating to the Near Eastern Question and the Balkan States, Including European Turkey and Modern Greece. Part 2. *Bull.* N. Y. Pub. Lib., Vol. 14, No. 3, pp. 199-226, 1910.

—— Öffentliche Arbeiten in Nordalbanien. *Österr. Monats. f. d. Orient,* Vol. 36, No. 2, pp. 13-15, 1910.

France

ALMEIDA, PROF. P. C. D'. Die Pariser Überschwemmung im Januar, 1910. *Pet. Mitt.,* Map. Vol. 56, No. 3, pp. 139-140, 1910.

ARBOS, PH. La Plaine du Roussilon. Maps. *Annal. de Géog.,* Vol. 19, No. 104, pp. 150-168, 1910.

DEMANGEON, A. Le Relief du Limousin. Ills. *Annales de Géog.,* Vol. 19, No. 104, pp. 120-148, 1910.

FOURNIER, E. Recherches spéléologiques et hydrologiques dans la Chaine du Jura. Maps. *Spelunca,* Vol. 7, No. 58, pp. 3-31, 1909.

MAILLET, E. La Crue extraordinaire de la Seine en Janvier 1910. Diagrams. *Annales de Géog.,* Vol. 19, No. 104, pp. 113-119, 1910.

ROTCH, PROF. A. L. The Aerological Congress at Monaco. *Bull.* Mount Weather Observatory, Vol. 2, Part 3, pp. 136-144, 1909.

TOUCHON, R. Massif des Cerces et de La Moulinière. Maps and Ills. *La Montagne,* Vol. 6, No. 3, pp. 133-146, Paris, 1910.

Germany and German Colonies

GRAVELIUS, PROF. DR. H. Zur Frage der Schiffahrtsabgaben aus deutchen Flüssen. Map. *Pet. Mitt.,* Vol. 56, No. 3, pp. 123-126, 1910.

MORDZIOL, DR. C. Ein Beweis für die Antezedenz des Rheindurchbruchtals nebst Beiträgen zur Entwicklungsgeschichte des Rheinischen Schiefergebirges. Ills. *Zeitschr.* d. Ges. für Erdkunde zu Berlin, Nos. 2, pp. 77-92 and 3, pp. 159-173, 1910.

—— Deutsche Sterbetafeln für das Jahrzehnt 1891 bis 1900. Tables. Statis. d. Deutsch. Reichs, Band 200, 215 pp., Berlin, 1910.

—— Die überseeische Auswanderung im Jahre 1909. Vierteljahrs. zur Statis. des Deutsch. Reichs, Vol. 19, No. 1, pp. 109-110, Berlin, 1910.

—— Erntestatistik für das Jahr 1909. Vierteljahrs. z. Statis. der Deutschen Reichs, Vol. 19, No. 1, pp. 77-96, Berlin, 1910.

—— Die Seereisen deutscher Schiffe. Vierteljahrs. Statis. z. der Deutsch. Reichs, Vol. 19, No. 1, pp. 102-105, Berlin, 1910.

—— Der Seeverkehr in den deutschen Hafenplätzen. im Jahre 1908. Vierteljahrs. zur Statis. d. Deutsch. Reichs, Vol. 19, No. 1, pp. 97-102, Berlin, 1910.

—— Zur Statistik der Preise. Grosshandelspreise wichtiger Waren an deut-

schen Plätzen im Jahre 1909 und in den 20 Jahren 1890 bis 1909. Statis. des Deutsch. Reiches, Vol. 19, No. 1, pp. 37-76, Berlin, 1910.

—— Zweiunddreissigster Jahresbericht über die Tätigkeit der Deutschen Seewarte für das Jahr 1909. Kaiserl. Marine, 52 pp., Hamburg, 1910.

—— Development of German Protectorates in 1908-9. *Board of Trade Jour.*, Vol. 68, No. 696, pp. 632-636, 1910.

The Netherlands

—— Meteorologie (a). Jaarboek, 1908. [In Dutch and French]. Kon. Nederl. Meteor. Inst., No. 97, 256 pp., Utrecht, 1909.

Scotland

—— Types of Vegetation in Scottish Lakes. Ills. *Scot. Geog. Mag.*, Vol. 26, No. 4, pp. 198-203, 1910.

Switzerland

FICKER, H. V. Der Transport Kalter Luftmassen über die Zentralalpen. Ills. *Denkschriften* der k. Akad. der Wiss., Math.-Naturwiss. Klasse, Vol. 80, pp. 131-200, Vienna, 1907.

POLAR REGIONS

BRUCE, DR. W. S. The Plans of the New Scottish Antarctic Expedition for 1911. Map. *Scot. Geog. Mag.*, Vol. 26, No. 4, pp. 192-195, 1910.

MOSSMAN, R. C. The Meteorology of the Weddell Quadrant and Adjacent Areas. 5 Plates. *Trans.* Royal Soc. of Edinburgh, Vol. 47, Part 1, No. 5, pp. 103-136, 1909.

SCHOTT, G. Zur Geographie des Grönlandsmeeres. Maps. *Annal.* d. Hydrog. u. Mar. Meteor., Vol. 38, No. 3, pp. 104-110, 1910.

—— Plan einer deutschen antarktischen Expedition. [Filchner's.] Map. *Zeits.* d. Gesell. für Erdk. zu Berlin, No. 3, pp. 153-158, 1910.

ECONOMIC GEOGRAPHY

HEINZE, EDUARD. Der Matte oder Paraná-Tee. Ills. *Beihefte zum Tropenpf.*, Vol. 11, No. 1, 63 pp., 1910.

SKREBENSKY-SOGA, BARON. Baumwolle und Baumwollindustrie. *Der Ostafrik. Pflanzer*, Vol. 2, No. 9, pp. 65-66. 1910.

HISTORICAL GEOGRAPHY AND BIOGRAPHY

MYRES, PROF. J. L. The Geographical Study of Greek and Roman Culture. Maps and Ills. *Scot. Geog. Mag.*, Vol. 26, No. 3, pp. 113-130, 1910.

MATHEMATICAL GEOGRAPHY AND ASTRONOMY

BEHRMANN, DR. WALTER. Zur Kritik der flächentreuen Projektionen der ganzen Erde und einer Halbkugel. Maps. *Sitzungsber.* d. k. bayerischen Akad. der Wissens., Math.-phys. Klasse, Abhandl. 13, 48 pp., Munich, 1909.

SCHELLER, DR. A. Über die Rotationszeit der Sonne. Diagram. *Denkschriften* d. k. Akad. d. Wiss., Math.-Naturwiss. Klasse, Vol. 84, pp. 35-52, 1909.

WEISS, E. Untersuchungen über die Bahnelemente der Kometen 1907 II und 1742. *Denkschriften* d. k. Akad. d. Wiss., Math.-Naturwiss. Klasse, Vol. 84, pp. 1-14, Vienna, 1909.

WESELY, DR. F. Definite Bahnbestimmung für den Kometen 1864 V. *Denkschriften* d. k. Akad. d. Wiss., Mathem.-Naturwiss. Klasse, Vol. 84, pp. 643-655, 1909.

PHYSICAL GEOGRAPHY

CZAPEK, F. Zur Kenntnis des Phytoplanktons im Indischen Ozean. Ills. *Sitzungsber.* der k. Akad. der Wissens., Math.-Naturwiss. Klasse, Vol. 118, No. 3, pp. 231-9, Vienna, 1909.

FRITSCHE, DR. H. Die mittlere Temperatur der Luft im Meeresniveau dargestellt als Funktion der geographischen Länge, Breit und fahreszeit. [Printed from photo-engravings of the Author's Manuscript.] Meteorol. Publikation 1. 144 pp., and Maps. Riga, 1909.

HANN, JULIUS. Der tägliche Gang der Temperatur in der äusseren Tropenzone. A. Das amerikanische und afrikanische Tropengebiet. *Denkschrift* der k. Akad. der Wissen., Math.-Naturw. Klasse, Vol. 80, pp. 317-404, Vienna, 1907.

KNOWLTON, A. A. The Present State of our Knowledge of Magnetic Materials. *Terr. Mag. and Atmosph. Electr.*, Vol. 15, No. 1, pp. 3-8, 1910.

—— Tiefseelotungen S. M. S. "Planet" 1909, unter dem Kommando von Korvettenkapitän v. Trotha. Maps and Diagrams. *Annal. d. Hydrog. und Mar. Meteor.*, Vol. 38, No. 3, pp. 98-103, 1910.

—— Upper Air Data. Summary of Data for the Year July 1, 1907 to June 30, 1908. Diagrams. *Bull.* Mount Weather Observ., Vol. 2, Part 3, pp. 145-182, 1909.

GENERAL

RUNGE, C. Über die Ortsbestimmung im Ballon. *Nachrichten* k. Gesell. d. Wiss. zu Göttingen, Mathem.-physik. Klasse, No. 3, pp. 289-307, Berlin, 1909.

SCHARFETTER, PROF. DR. R. Pflanzen und Völkergrenzen, *Pet. Mitt.*, Vol. 56, No. 3, pp. 121-123, 1910.

—— Completion of the First Cruise of the "Carnegie." Ill. *Terr. Magn. and Atmosph. Electr.*, Vol. 15, No. 1, pp. 1-2, 1910.

NEW MAPS

NORTH AMERICA

U. S. HYDROGRAPHIC OFFICE CHARTS

Pilot Chart of the North Atlantic Ocean, May, 1910. [On the reverse are a short history and ephemeris of Halley's Comet.]

Pilot Chart of the North Pacific Ocean, May, 1910.

WEATHER BUREAU CHARTS

Meteorological Chart of the North Atlantic Ocean, June, 1910.

Meteorological Chart of the South Atlantic Ocean, June, July, August, 1910.

Meteorological Chart of the North Pacific Ocean, June, 1910.

Meteorological Chart of the South Pacific Ocean, June, July, August, 1910.

CALIFORNIA. Map of the San Francisco Bay Region showing Distribution of shell heaps. 1 inch=2.5 miles. Illustrates "Shellmounds of the San Francisco Bay Region," by N. C. Nelson. Univ. of Cal. Pub. in Amer. Arch. and Eth., Vol. 7, No. 4. Berkeley, 1909.

NEW YORK. The Indian Occupancy of the Niagara Frontier. No Scale. By Frederick Houghton. Illustrates "Indian Villages, Camp and Burial Sites on the Niagara Frontier" (same author). *Bull.* Buffalo Soc. of Nat. Sci., Vol. 9, No. 3, Buffalo, 1909. [Black sketch map.]

NEW YORK. Map of Port Henry and Vicinity. 1:63,360=1 mile to an inch. Contour interval, 20 feet. In N. Y. State Museum *Bull.* 138, Albany, 1910. [Location of iron mines indicated by numbers referring to the text.]

NEW YORK. Geological Map of the Elizabethtown-Port Henry Quadrangles. 1:62,500=0.9 mile to an inch. Contour interval, 20 feet. Illustrates N. Y. State Museum *Bull.* 138, Albany, 1910. [The map includes the work both of the U. S. and the N. Y. State Geol. Surveys and is accompanied by a sheet showing geological sections along lines indicated on main sheet. Colors show geological detail.]

PORTO RICO. Road and Railroad Map of Porto Rico. No Scale. With Reports of Governor and other Officials of Porto Rico, in *Annual Reports* of War Department, Vol. 9, Washington, 1909. [A black sketch map showing wagon roads and railroads in operation or projected.]

VIRGINIA. MAP OF THE U. S. NAVY YARD, NORFOLK, VA. 1 inch=600 feet. With "The Development of the Norfolk Navy Yard," by Civ. Eng. A. C. Cunningham. In *Proc.* U. S. Naval Inst., Vol. 36, No. 1, Annapolis, Md., 1910.

WEST VIRGINIA. Map showing approximate Location of diamond drill holes described in Vol. 2 (A) of Reports of W. Va. Geological Survey. 1 inch=4 miles. I. C. White, State Geologist. Drawn by Ray V. Hennen, Ass't. Geologist. Morgantown, 1908. [The borings were made during investigations of coal resources of the state.]

WEST VIRGINIA. Map of West Virginia showing Railroads and County Products, 1905. 1 inch=12 miles. I. C. White, State Geologist. Drawn from Government and other Surveys by Ray V. Hennen. W. Va. Geol. Surv., Morgantown, 1910. [The varous railroad lines shown in differing colors. Tables of principal products of each county and other statistics.]

WEST VIRGINIA. Map of W. Va. showing coal, oil, gas and limestone areas. 1 inch=7 miles. Geologic Features by I. C. White, State Geologist. Base map by Ray V. Hennen, Ass't. Geologist, from topographic sheets of U. S. Geol. Surv. W. Va. Geol. Surv., Morgantown, 1908. [A good economic map showing mineral and gas areas in colors, with brown contours of elevation. The coal mines are numbered with reference to list of mining companies on margin.]

CANADA. (a) Atlas of Canada. No. 7: Minerals. 1 inch=100 miles. [Colored symbols for distribution of minerals south of 68° N. Lat.]; (b) Map of the Dominion of Canada. 1 inch=100 miles. [Showing, in red, the wheat area in Manitoba, Saskatchewan and Alberta surveyed up to Jan. 1, 1908, with points farther north where wheat has been grown]; (c) 20 Maps of Canada on one sheet showing temperatures, isotherms, isobars, precipitation, rainfall, snow-

fall and average possible hours of sunshine in the summer months; (d) Northern Canada. 1 inch=25 miles. 52°-60° N.; 93°-120° W. [Showing navigation, quality of soils, distribution of timber, etc. Illustrate "Canada's Fertile Northland." Dep't. of the Interior, Ottawa, 1907.]

CANADA. Explored Routes in a portion of Northwestern Ontario traversed by the National Transcontinental Railway between Lake Nipigon & Sturgeon Lake. 1 inch=4 miles. 49° 50′-51° N.; 88° 30′-91° 45′ W. With "A Geological Reconnaissance of the Region traversed by the Nat. Trans. R.R. between Lake Nipigon and Clay Lake, Ont." By W. H. Collins. Dep't. of Mines, Geol. Surv. Branch, Ottawa, 1909, No. 1059. [Geological formations in colors.]

SOUTH AMERICA

ARGENTINA. Geologische Übersichtsskizze des südöstlichen Chubuts. 1:500,000=7.89 miles to an inch. With "Geologische Beschreibung der Umgebung des Sees Musters in Patagonien," by Richard Stappenbeck. In *Sitzungsber.* d. k. Akad. d. Wissens., Math.-Naturwissens. Klasse, 117 Band, 9 u. 10 Heft., Abt. I, Vienna, 1908. [10 colored symbols for formations.]

CHILE. Karte von Chile u. d. angrenzenden Gebieten Argentiniens u. Boliviens unter Zugrundelegung d. Stieler'schen Karte, photolithographisch vergrössert, u. unter d. Redaction von Dr. L. Friederichsen d. Martin'schen Landeskunde von Chile angepasst. 1:5,000,000=78.9 miles to an inch. L. Friederichsen & Co., Hamburg, 1909. [Illustrates "Landeskunde von Chile," by the late Dr. Martin. Boundaries in red, symbols for towns according to population, and a large variety of other information.]

AFRICA

ANGLO-EGYPTIAN SUDAN. Stations at which Rainfall was measured in 1908 in the Basin of the Upper Nile. 1:7,500,000=118.35 miles to an inch. In "The Rains of the Nile Basin and the Nile Flood of 1908," by Capt. H. G. Lyons. Survey Dep't. *Paper,* No. 14, Surv. Dep't., Egypt, Cairo, 1909. [A black Map indicating rainfall stations.]

ANGLO-EGYPTIAN SUDAN. The Sudan Province of Kordofan. 1:2,000,000=31.56 miles to an inch. With paper "Notes on Kordofan Province," by Captain Watkiss Lloyd. *Geog. Jour.,* Vol. 35, No. 3, London, 1910. [Shows a network of tracks cleared or being cleared, other routes, telegraph, water courses, large nomenclature, etc.]

BELGIAN CONGO. Carte des Concessions de l'Union minière du Haut Katanga. 1:2,000,000=31.56 miles to an inch. With paper "Les Gisements miniers du Katanga" in *Le Mouve. Géog.,* Vol. 27, No. 8, Brussels, 1910. [Shows, in colors, the copper, tin, gold, iron and coal areas with mining concessions.]

BRITISH-FRENCH SUDAN. Lac Tchad. Aspect en Avril, 1908, tel qu'il résulte des levés faits de Novembre, 1907 à Mai, 1908. Par Capt. Tilho (and other members of the Tilho Mission, the work of previous explorers also being used). 1:500,000=7.89 miles to an inch. Illustrates "Le Tchad et les pays-bas du Tchad," by Capt. Jean Tilho. *La Géog.,* Vol. 21, No. 3, Paris, 1910. [Gives, in colors, the results of the most thorough survey of the lake yet made, showing

its rapid desiccation, many routes through the lake, soundings and elevations in meters, points astronomically determined, etc., together with a large amount of information on the country for 2° north of Lake Chad.]

CAMEROONS. Reisewege der Kamerun-Expedition, 1907-08. 1:2,500,000=39.4 miles to an inch. With "Forschungs-Expedition in das Kamerun-Gebirge und ins Hinterland von Nordwest-Kamerun." By Dr. K. Hassert. *Zeits.* d. Gesell. f. Erdkunde zu Berlin, No. 1, Berlin, 1910. [Showing routes of the explorers with elevations in brown.]

EGYPT. Distribution of Iron Ores in Egypt. 1:3,000,000=47.34 miles to an inch. In Surv. Dep't. *Paper* 20, "Distribution of Iron Ores in Egypt," by W. F. Hume. Geol. Surv., Cairo, 1909. [Black map showing iron ore distribution between the Mediterranean and Wadi Halfa and from the Libyan oases in the west to the Red Sea in the east.]

GERMAN EAST AFRICA. Stadtplan von Daressalam. 1 inch=550 meters. Illustrates "Daressalam" in *Deut. Kolonialz.* Vol. 27, No. 6, Berlin, 1910. [Black.]

LIBERIA. Libéria. Itinéraire suivi par M. Moret, de Cribo à Sinoe. 1:750,000=11.84 miles to an inch. With "A travers le Libéria (same author). *La Géog.*, Vol. 21, No. 1, Paris, 1910. [A black map with many new place names.]

LIBERIA. Prismatic Compass Traverse in Liberia. By Capt. C. Braithwaite Wallis. 1:500,000=7.89 miles to an inch. With paper "A Tour in the Liberian Hinterland" (same author), in *Geog. Jour.*, Vol. 35, No. 3, London, 1910. [Includes approximate boundaries of Chiefdoms.]

MAURITANIA. Mauritanie orientale d'apres Lieut. Laronne. 1:2,500,000=39.4 miles to an inch. Illustrates "La Mauritanie orientale" (same author), *La Géog.*, Vol. 21, No. 4, Paris, 1910. [A black map giving a large amount of new data relating to this little known region in the southwestern Sahara.]

RHODESIA. Map of Northern Rhodesia and adjacent Territories, showing Faunistic Areas. 1:5,000,000=78.9 miles to an inch. By S. A. N. Neave. With paper "A Naturalist's Travels on the Congo-Zambezi Watershed." *Geog. Jour.*, Vol. 35, No. 2, London, 1910. [Three tints to show areas of South, Central and West African Fauna.]

SAHARA. Approximate Distribution of Sand Dunes of the Libyan Desert. 1:7,500,000=118.35 miles to an inch. By H. J. L. Beadnell. 24°-32° N.; 22°-34° E. With paper (same title and author), in *Geog. Jour.*, Vol. 35, No. 4, London, 1910. [Showing geological formations and the dune regions.]

SAHARA. Itinéraires parcourus par le Capitaine Cordier dans le Pays des Ioulliminden. 1:5,000,000=78.9 mils to an inch. 15°-20° N.; 2° 20' W.-7° E. of Paris. Illustrates "Le Pays des Touaregs Ioulliminden." *La Géog.*, Vol. 21, No. 4, Paris, 1910. [A black map giving the itineraries of Capt. Cordier. All locations noted on his routes were fixed astronomically.]

SAHARA. Croquis schématique des Territoires au nord-est du Tchad. 1:5,000,000. Illustrates "Les régions au nord-est du Tchad (Mission de délimitation Niger-Tchad-Mission Tilho)." *La Géog.*, Vol. 21, No. 4, Paris, 1910. [A black map showing the Mission and other itineraries and some new place names, wells and surface features.]

TUNIS. Situation agricole des Territoires du sud Tunisien. No Scale. Illustrates "Note sur la Situation économique du Sud de la Régence de Tunis, et sur l'Avenir de cette Région." *Bull.* Sec. tunisienne de la Soc. Géog. Comm. de Paris, No. 2, Tunis, 1909. [Colored to show sources of artesian wells, and regions favorable for the cultivation of the palm and olive.]

ASIA

ASIATIC TURKEY AND W. PERSIA. Part of Kurdistan. 1:2,000,000=31.56 miles to an inch. 35°-40° N.; 41°-47° E. With paper by Capt. Bertram Dickson, "Journeys in Kurdistan." *Geog. Jour.*, Vol. 35, No. 4, London, 1910. [Colors differentiate leading topographical features.]

ARABIA. Sketch Map of North West Arabia. Showing the explorations of Douglas Carruthers, 1909. 1:2,000,000=31.56 miles to an inch. With paper "A Journey in North-Western Arabia," by Mr. Carruthers. *Geog. Jour.*, Vol. 35, No. 3, London, 1910. [Based on a prismatic compass survey in the region included between 27° 30′-32° 10′ N.; 34°-40° E.]

CHINA. Part of Western Sechuan. 1:1,000,000=15.78 miles to an inch. From a Plane table Survey by J. W. Brooke. Illustrates "Mr. J. W. Brooke's Journeys in Western Sze-chuan." By C. H. Meares. *Geog. Jour.*, Vol. 34, No. 6, London, 1909. [The map contains the results of Mr. Brooke's surveys up to a short time before he was murdered by the Lolos, about the end of 1908.]

HIMALAYA. The Hispar Glacier and Tributaries in the Karakoram Range, explored by the Bullock Workman Expedition, 1908. 1:150,000=2.38 miles to an inch. With paper "The Hispar Glacier," by Dr. and Mrs. Workman. *Geog. Jour.*, Vol. 35, No. 2, London, 1910.

INDIA. India, showing the Progress of the Imperial Surveys to 1st October, 1908. 1 inch=128 miles. In *General Report* of the Survey of India during 1907-08. Calcutta, 1909. [Colors show areas covered by completed or progressing topographic surveys, by the various revenue surveys and by geographical reconnaissance, on various scales.]

MESOPOTAMIA. The Tigris-Euphrates Delta. 1:3,000,000=47.34 miles to an inch. Illustrates a paper by Sir W. Willcocks: "Mesopotamia: Past, Present and Future." With inset showing railroads, built or projected, between Constantinople and the Persian Gulf. *Geog. Jour.*, Vol. 35, No. 1, London, 1910. [Red tint indicates land capable of early development.]

SUMATRA (south). Schetskaart der Onderafdeeling Koeboestreken. 1:500,000=7.89 miles to an inch. Illustrates "De Koeboes in de Onderafdeeling Koeboestreken der Residentie Palembang." By G. J. Van Dongen. *Bijdragen* tot de Taal-Land-en Volkenkunde van Neder.-Indie, Vol. 7, Nos. 3-4, The Hague, 1910.

EUROPE

AUSTRIA. Verbreitung des Erdbebens vom 19 Feb., 1908, in Niederösterreich. 1:1,000,000. With "Bericht über das Erdbeben vom 19. Feb., 1908" in *Mitt.* d. Erdbeben-Kommission d. k. Akademie d. Wissens. in Wien, No. 34, Wien, 1908.

AUSTRIA-HUNGARY. Der Triester Karst mit seiner Höhlen und seinen problematischen unterirdischen Höhlenwässern. 1:150,000=2.38 miles to an inch. By G. A. Perko. Illustrates "Zur österreichischen Karsthöhlenforschung" (same author). In *Deuts. Runds. f. Geog. u. Stat.*, Vol. 32, No. 6, Vienna, 1910. [Shows caves, probable courses of undergound waters, surface waterpartings, etc.]

BALKANS. Geologie des nördlichen Albaniens. No scale. Illustrates paper (same title), by H. Vetters, in *Denkschriften* d. k. Akad. d. Wiss., math.-naturw. Klasse, Vol. 80, Vienna, 1907. [Formations in colors.]

BALKANS. Die Vegetations Regionen der Balkanhalbinsel. 1:2,000,000=31.56 miles to an inch. By Prof. Dr. L. Adamovic. Illustrates paper "Pflanzengeographie der Balkanhalbinsel," by same author. *Denkschriften* d. k. Akad. d. Wiss., math.-naturw. Klasse, Vol. 80, Vienna, 1907. [16 symbols in colors to show distribution of flora.]

BALKANS. Vegetationsgrenzen, Verbreitung, Areal u. Standorte d. wichtigsten Holzgewächse d. Balkanhalbinsel. 1:3,000,000=47.34 miles to an inch. By Prof. Dr. L. Adamovic. *Denkschriften* d. k. Akad. d. Wiss., math.-naturw. Klasse, Vol. 80, Vienna, 1907.

BALKANS. Pflanzengeographische Karte Bulgariens, Ostrumeliens, Nordthraziens und Nordmazedoniens. 1:750,000=11.84 miles to an inch. Illustrates paper (same author) "Die Verbreitung der Holzgewächse in Bulgarien und Ostrumelien." *Denkschriften* d. k. Akad. d. Wiss., math.-naturw. Klasse, Vol. 84, Vienna, 1909.

FRANCE. Glaciers du Massif des Grandes-Rousses. 1.10,000=0.1 mile to an inch. With "Travaux topographiques et glaciologiques dans le massif des Grandes-Rousses," by G. Flusin and Ch. Jacob. *La Géog.*, Vol. 21, No. 1, Paris, 1910. [Mountains in brown, blue contours for elevations of glacier surfaces, symbols for moraines, etc.]

FRANCE. Tremblement de Terre du 11 Juin, 1909. Intensité de la Secousse princ'pale. Carte dressée par A. Angot. Illustrates paper (same title) by A. Angot and P. Lemoine. *Annales de Géog.*, Vol. 19 (No. 103), Paris, 1910. [Shows, in colors, the degrees of intensity noted according to the Forel-Mercalli Scale.]

RUMANIA. Formarea Deltei Dunarei. 1:400,000=6.3 miles to an inch. Illustrates paper (same title) by Captain M. D. Ionescu in *Buletin*, Rumanian Geog. Soc., Vol. 30, No. 1, Bucharest, 1909. [Map, in colors, of the Danube Delta.]

WORLD

MAPS OF THE CONTINENTS. Mercator Projection. (a) Biographische Gliederung d. Kontinente; (b, c) Ausbreitung d. Säugetiere, 1 & 2; (d, e) Ausbreitung d. Reptilien, 1 & 2; (f) Ausbreitung d. Amphibien u. d. Dipnoer; (g) Gebirgskarte d. Erde; (h) Karte d. Gezeitenwirkung u. d. tetrædrischen Deformation; (i-r) 10 Karten d. Kontinente während des Kambrium, de Silurzeit, Devonzeit, Karbonzeit, Triaszeit, Jurazeit, Kreidezeit, älteren Tertiärzeit, jüngeren Tertiärzeit, Diluvialzeit; (s) Ausbreitung der Menschenrassen. [Maps in colors illustrating "Die Entwicklung der Kontinente und Ihrer Lebewelt," by Dr. Theodor Arldt.]